

PROGRAMME: B.E.
ELECTRONICS AND COMMUNICATION ENGINEERING
CURRICULUM

SEMESTER 1										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1101	Engineering Mathematics - I	3	*	0	3	50	50	1
2	Theory	SPHA1101	Physics for Engineers	3	1	0	4	50	50	2
3	Theory	SEEA1101	Electrical Technology	3	*	0	3	50	50	4
4	Theory	SCSA1202	Programming in C and C++	3	0	0	3	50	50	5
5	Theory	SECA1101	Electronic Devices	3	0	0	3	50	50	6
6	Theory	SMEA1102	Engineering Drawing	1	0	4	3	50	50	7
7	Practical	SPHA2101	Physics Lab	0	0	2	1	25	25	8
8	Practical	SEEA2101	Electrical Engineering Lab	0	0	4	2	50	50	9
9	Practical	SECA2101	Electronic Devices Lab	0	0	4	2	50	50	10
Total Credits for Semester 1 - 24										
Total Marks for Semester 1 - 850										

SEMESTER 2										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SHSA1101	Technical English	3	0	0	3	50	50	11
2	Theory	SMTA1201	Engineering Mathematics - II	3	*	0	3	50	50	14
3	Theory	SCYA1101	Engineering Chemistry	3	1	0	4	50	50	15
4	Theory	SCSA1203	Data structures	3	0	0	3	50	50	17
5	Theory	SBTA1101	Environmental Science and Engineering	2	0	0	-	-	-	18
6	Theory	SECA1201	Digital Logic Circuits	3	0	0	3	50	50	19
7	Practical	SCYA 2101	Engineering Chemistry Lab	0	0	2	1	25	25	20
8	Practical	SCSA2202	Programming in C & Data Structures Lab	0	0	4	2	50	50	21
Total Credits for Semester 2 - 19										
Total Marks for Semester 2 - 650										

L - LECTURE HOURS, T - TUTORIAL HOURS, P - PRACTICAL HOURS, C - CREDITS

CAE - CONTINUOUS ASSESSMENT EXAMINATION

ESE - END SEMESTER EXAMINATION,

SEMESTER 3										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1301	Engineering Mathematics - III	3	*	0	3	50	50	22
2	Theory	SEEA1304	Electrical Circuits and Network Analysis	3	*	0	3	50	50	23
3	Theory	SECA1301	Signals and Systems	3	0	0	3	50	50	24
4	Theory	SECA1307	Electronic Circuits - I	3	*	0	3	50	50	26
5	Theory	SEEA1302	Electromagnetic Theory	3	*	0	3	50	50	27
6	Theory	SECA1303	Analog Communication	3	0	0	3	50	50	28
7	Practical	SECA2301	Circuits and Networks Lab	0	0	4	2	50	50	30
8	Practical	SECA2302	Electronic Circuits - I Lab	0	0	4	2	50	50	31
9	Project	S13ADPROJ	Design Thinking				2		100	32
Total Credits for Semester 3 - 24										
Total Marks for Semester 3 - 900										

SEMESTER 4										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SMTA1401	Engineering Mathematics - IV	3	*	0	3	50	50	32
2	Theory	SECA1401	Electronic Circuits - II	3	*	0	3	50	50	33
3	Theory	SECA1402	Transmission Lines and Wave guides	3	*	0	3	50	50	34
4	Theory	SECA1403	Digital Communication	3	0	0	3	50	50	35
5	Theory		Professional Elective - I	3	0	0	3	50	50	
6	Theory	SAIC4001 / SECA1406	Industry 4.0 Industry 5.0 for Electronics Engineers (From 2020 Batch Onwards)	2	0	0	2	50	50	36
7	Practical	SECA2401	Electronic Circuits - II Lab	0	0	4	2	50	50	37
8	Practical	SECA2402	Communication Engineering Lab	0	0	4	2	50	50	38
9	Theory	SAIC4003	Universal Human Values	2	1	0			100	
Total Credits for Semester 4 - 23										
Total Marks for Semester 4 - 900										

L - LECTURE HOURS, T - TUTORIAL HOURS, P - PRACTICAL HOURS, C - CREDITS

CAE - CONTINUOUS ASSESSMENT EXAMINATION

ESE - END SEMESTER EXAMINATION,

SEMESTER 5										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SECA1506	Digital Signal Processing	3	*	0	3	50	50	39
2	Theory	SECA1502	Analog Integrated Circuits	3	0	0	3	50	50	40
3	Theory	SECA1503	CMOS VLSI Design	3	0	0	3	50	50	41
4	Theory	SECA1505	Antennas and Wave Propagation	3	*	0	3	50	50	42
5	Theory		Open Elective I	3	0	0	3	50	50	
6	Theory	SEEA1502	Control Systems	3	*	0	3	50	50	43
7	Practical	SECA2501	Digital Signal Processing Lab	0	0	4	2	50	50	44
8	Practical	SECA2502	Analog Integrated Circuits Lab	0	0	4	2	50	50	45
9	Practical	S13APT	Professional Training	0	0	4	2	50	50	
10	Project	S13AEPICS	Engineering Projects in Community Service						100	
Total Credits for Semester 5 - 24										
Total Marks for Semester 5 - 900										

SEMESTER 6										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SECA1601	Microprocessors and Microcontrollers	3	0	0	3	50	50	46
2	Theory	SECA1605	Programming in HDL	3	0	0	3	50	50	47
3	Theory	SECA1606	Embedded Systems	3	0	0	3	50	50	48
4	Theory	SECA1604	Computer Networks	3	0	0	3	50	50	49
5	Theory		Open Elective - II	3	0	0	3	50	50	
6	Practical	SECA2601	Microprocessor and Microcontroller Lab	0	0	4	2	50	50	51
7	Practical	SECA2602	VLSI Design Lab	0	0	4	2	50	50	52
8	Project	S13AIPROJ	Interdisciplinary Project	0	0	6	3	50	50	
Total Credits for Semester 6 - 22										
Total Marks for Semester 6 - 800										

L - LECTURE HOURS, T - TUTORIAL HOURS, P - PRACTICAL HOURS, C - CREDITS

CAE - CONTINUOUS ASSESSMENT EXAMINATION

ESE - END SEMESTER EXAMINATION,

SEMESTER 7										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SECA1701	Microwave and Optical Communication	3	0	0	3	50	50	53
2	Theory	SECA1704	Contemporary Wireless Communication	3	0	0	3	50	50	55
3	Theory	SECA1703	Internet of Things	3	0	0	3	50	50	56
4	Theory		Professional Elective II	3	0	0	3	50	50	
5	Theory		Open Elective III	3	0	0	3	50	50	
6	Practical	SECA2701	Microwave and Optical Lab	0	0	4	2	50	50	57
7	Project	S13APROJ1	Project Work (Phase - I)	0	0	6	3	50	50	
Total Credits for Semester 7 - 20										
Total Marks for Semester 7 - 700										

SEMESTER 8										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1	Theory	SBAA4002	Principles of Management and Professional Ethics	3	0	0	3	50	50	58
2	Theory		Professional Elective III	3	0	0	3	50	50	
3	Project	S13APROJ2	Project Work (Phase - II)	0	0	14	7	50	50	
Total Credits for Semester 8 - 13										
Total Marks for Semester 8 - 300										

L - LECTURE HOURS, T - TUTORIAL HOURS, P - PRACTICAL HOURS, C - CREDITS

CAE - CONTINUOUS ASSESSMENT EXAMINATION

ESE - END SEMESTER EXAMINATION,

Semester	Theory courses (including elective courses)			Practical Courses (including PT and project)		
	Total No.	Total Credits	Total Marks	Total No.	Total Credits	Total Marks
1	6	19	600	3	5	250
2	6	16	600	2	3	150
3	6	18	600	3	6	300
4	7	19	700	2	4	200
5	6	18	600	4	8	400
6	5	15	500	3	7	300
7	5	15	500	2	5	200
8	2	6	200	1	7	100
Overall Total	42	126	4300	18	45	1900

Overall total credits for B.E ECE	169
Overall total marks for B.E ECE	6200

L - LECTURE HOURS, T - TUTORIAL HOURS, P - PRACTICAL HOURS, C - CREDITS

CAE - CONTINUOUS ASSESSMENT EXAMINATION,

ESE - END SEMESTER EXAMINATION, VIVA - VIVAVOCE

LIST OF ELECTIVES

PROFESSIONAL ELECTIVE COURSES									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1	SECA3001	Cryptography and Network security	3	0	0	3	50	50	59
2	SEIA3001	Measurements and Instrumentation	3	0	0	3	50	50	60
3	SEIA1603	Biomedical Instrumentation	3	0	0	3	50	50	61
4	SECA3025	Telecommunication Systems and Services	3	0	0	3	50	50	62
5	SECA3019	Embedded Processor	3	0	0	3	50	50	63
6	SECA3004	Computer Architecture and Operating System	3	0	0	3	50	50	64
7	SECA3005	Biomedical Signal Processing	3	0	0	3	50	50	65
8.	SECA3006	ASIC Design	3	0	0	3	50	50	66
9.	SECA3007	MEMS and its applications	3	0	0	3	50	50	67
10.	SECA3008	Wireless Sensor Networks	3	0	0	3	50	50	68
11.	SECA3009	Digital Image Processing	3	0	0	3	50	50	69
12.	SEIA3006	Robotics and Automation	3	0	0	3	50	50	70
13.	SECA3010	RF IC Design	3	0	0	3	50	50	71
14.	SECA3011	Artificial Intelligence	3	0	0	3	50	50	72
15.	SECA3012	Cellular Mobile Networks	3	0	0	3	50	50	73
16.	SECA3013	Radar and Navigational Aids	3	0	0	3	50	50	74
17.	SECA3014	Electronic Test Engineering	3	0	0	3	50	50	75
18.	SECA3015	Satellite Communication	3	0	0	3	50	50	76
19.	SECA3016	Mobile Adhoc Networks	3	0	0	3	50	50	77
20.	SECA3017	Optical Networks	3	0	0	3	50	50	79
21.	SECA3018	Nano electronics	3	0	0	3	50	50	81
22.	SEIA3004	Soft Computing Techniques	3	0	0	3	50	50	82
23.	SCSA1601	Machine Learning	3	0	0	3	50	50	83
24	SCSA1102	Python Programming	3	0	0	3	50	50	84
25	SECA3029	Drone Electronics	3	0	0	3	50	50	85
26	SECA3032	AI in Robotics	3	0	0	3	50	50	86
27	SECA3021	Digital System Design and Verification using System Verilog	3	0	0	3	50	50	87
32	SECA3022	Graphical Programming for Engineers	3	0	0	3	50	50	92
33	SECA3023	Augmented Reality and Virtual Reality	3	0	0	3	50	50	93
34	SECA3024	Advanced Electronic Test Engineering	3	0	0	3	50	50	94

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 ESE - END SEMESTER EXAMINATION

OPEN ELECTIVE COURSES									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1	SALA4001	Intellectual Property Law	3	0	0	3	50	50	A1
2	SAEA4001	Fundamentals of Aerospace Technology	3	0	0	3	50	50	A2
3	SBAA4001	Fundamentals of Management	3	0	0	3	50	50	A3
4	SBAA4002	Principles of Management and Professional Ethics	3	0	0	3	50	50	A4
5	SBTA4001	Biology for Engineers	3	0	0	3	50	50	A5
6	SBMA4001	Neurology	3	0	0	3	50	50	A6
7	SBMA4002	Modelling of Physiological Systems	3	0	0	3	50	50	A7
8	SBMA4003	Drug Delivery System	3	0	0	3	50	50	A8
9	SBMA4004	Fundamentals of Mechatronics	3	0	0	3	50	50	A9
10	SBMA4005	Virtuality and Augmented Reality	3	0	0	3	50	50	A10
11	SBMA4006	Medical Optics and Laser Applications	3	0	0	3	50	50	A11
12	SBMA4007	Forensic Science	3	0	0	3	50	50	A12
13	SBMA4008	Artificial Intelligence and Expert Systems	3	0	0	3	50	50	A13
14	SBMA4009	Human Factors in Engineering and Design	3	0	0	3	50	50	A14
15	SCHA4001	Corrosion Engineering	3	0	0	3	50	50	A15
16	SCHA4002	Energy Engineering	3	0	0	3	50	50	A16
17	SCHA4003	Environmental Impact Assessment	3	0	0	3	50	50	A17
18	SCHA4004	Environmental Pollution and Control	3	0	0	3	50	50	A18
19	SCIA4001	Disaster Management	3	0	0	3	50	50	A19
20	SCSA4001	R Programming	3	0	0	3	50	50	A20
21	SCSA4002	5 G Networks	3	0	0	3	50	50	A21
22	SECA4001	Software Tools for Engineering Applications	3	0	0	3	50	50	A22
23	SMEA4001	Resource Management Techniques	3	0	0	3	50	50	A23
24	SMEA4002	Wind and Solar Energy	3	0	0	3	50	50	A24
25	SAE 1605	Airport Engineering	3	0	0	3	50	50	A25
26	SAU1604	Hybrid and Electric Vehicles	3	0	0	3	50	50	A26
27	SCIA3004	Solid waste Management	3	0	0	3	50	50	A27
28	SCSA3019	Augmented and Virtual Reality	3	0	0	3	50	50	A28
29	SECA3011	Artificial Intelligence	3	0	0	3	50	50	A29
30	SECA4002	Deep Learning Neural Networks	3	0	0	3	50	50	A30
31	SECA4003	Drone Electronics	3	0	0	3	50	50	A31
32	SECA4004	e-Health	3	0	0	3	50	50	A32

33	SEE1611	Electric Vehicles	3	0	0	3	50	50	A33
34	SITA3011	Block Chain Technologies	3	0	0	3	50	50	A34
35	SVCA2501	Film Appreciation	3	0	0	3	50	50	A35
36	SEEA3027	Green Energy Systems	3	0	0	3	50	50	A36
37	SCSA4003	Business Analytics	3	0	0	3	50	50	A37
38	SCHA3008	Food Technology	3	0	0	3	50	50	A38
39	SECA4005	Industrial Internet of Things	3	0	0	3	50	50	A39
40	SCIA4002	Public Health Engineer	3	0	0	3	50	50	A40
41	SCSA4007	Design and Development of Blockchain	3	0	0	3	50	50	A41
42	SECA4007	Real Time System Design	3	0	0	3	50	50	A42
43	SEC1626	System Programming	3	0	0	3	50	50	A43
44	SEC1627	EMBEDDED LINUX BSP & PERFORMANCE TUNING	3	0	0	3	50	50	A45
45	SAUA3013	Alternate Fuels and Energy Systems	3	0	0	3	50	50	A46
46	SAUA3012	Fuel Cell and Applications	3	0	0	3	50	50	A47
47	SCSA3016	Data Science	3	0	0	3	50	50	A48
48	SMEA3012	Industrial Robotics and Expert Systems	3	0	0	3	50	50	A49
49	SECA3030	Digital Image Processing for Real Time Applications	3	0	0	3	50	50	A50
50	SECA3020	5G Communication	3	0	0	3	50	50	A51
51	SECA3028	Machine learning techniques	3	0	0	3	50	50	A52
53	SECA3027	IoT for Real Time Application	3	0	0	3	50	50	A53

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CAE - CONTINUOUS ASSESSMENT EXAMINATION,

ESE - END SEMESTER EXAMINATION

SCSA1202	PROGRAMMING IN C AND C++	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the fundamental programming concepts and methodologies which are essential to building good C/C++ program.
- To demonstrate a thorough understanding of modular programming by designing programs which require the use of programmer-defined functions.
- To impart the knowledge about pointers which is the backbone of effective memory handling.
- To demonstrate adeptness of object oriented programming in developing solutions to problems demonstrating usage of data abstraction, encapsulation, and inheritance.

UNIT 1 BASICS OF C PROGRAMMING**9 Hrs.**

Introduction to C: Features of C - Structure of C program-Data Types-'C' Tokens-Input/output statements-Control Statement, Functions: - Types of Functions -Recursion.

UNIT 2 ARRAYS, STRINGS AND STRUCTURES**9 Hrs.**

Arrays : Single and Multidimensional Arrays– Array as Function Arguments, Strings: String Handling Functions, Structure: Nested Structures - Array of Structures - Structure as Function Argument-Function that Returns Structure, Union.

UNIT 3 POINTERS AND FILE PROCESSING**9 Hrs.**

Pointers: Introduction, Arrays Using Pointers - Structures Using Pointers - Functions Using Pointer, Dynamic Memory Allocation, Storage Classes, File Handling in 'C'.

UNIT 4 OBJECT ORIENTED PROGRAMMING CONCEPTS**9 Hrs.**

Introduction-Procedure vs. object oriented programming-Concepts: Classes and Objects-Operator & Function Overloading-Inheritance-Polymorphism and Virtual Functions.

UNIT 5 TEMPLATES AND EXCEPTION HANDLING**9 Hrs.**

Function Templates and Class Templates - Name spaces - Standard Template Library - Casting - Exception Handling - case study.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Develop simple applications in C using basic constructs.
- CO2 - Design and Implement applications using arrays and strings.
- CO3 - Develop and Implement applications using memory allocation and File concepts.
- CO4 - Use proper class protection to provide security.
- CO5 - Describe the reusability of code through Inheritance.
- CO6 - Demonstrate the use of virtual functions to implement polymorphism.

TEXT / REFERENCE BOOKS

- Deitel and Deitel, "C how to Program", 7th Edition, Pearson Education, 2013.
- Brian W.Kernighan and Dennis M.Ritchie, "The C Programming Language", Pearson Education, 2015.
- Yashavant Kanetkar, "Understanding Pointers in C", 4th Revised & Updated Edition, Bbp Publications, 2008.
- E Balagurusamy, "Object Oriented Programming with C++", 3rd Edition, Tata McGraw Hill, 2006.
- Bhave, "Object Oriented Programming with C++", Pearson Education, 2004.
- John R Hubbard, "Programming with C++", Schaums Outline Series, McGraw Hill, 2nd Edition, 2009.
- Bjarne Stroustrup, "Programming: Principles and Practice using C++", 1st Edition, Addison Wesley Publications, 2008.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2marks each-No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SECA1101	ELECTRONIC DEVICES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To acquaint the students with the construction, theory and operation of the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices.
- To understand the mechanisms of current flow in semi-conductors.
- To familiarize on the principle of operation, capabilities and limitation of various advanced semiconductor devices and its practical application.
- To design practical circuits with alternate electronic devices.
- To study about the display devices and power semiconductors.

UNIT 1 SEMICONDUCTOR DIODE**9 Hrs.**

PN junction diode- construction and operation, Current equations, Diffusion and drift current densities, forward and reverse bias characteristics, Breakdown in PN Junction Diodes. Applications- Rectifiers, Limiting and Clamping Circuits, Zener diode- construction and VI characteristics.

UNIT 2 BIPOLAR JUNCTION TRANSISTOR**9 Hrs.**

Bipolar junction transistors, NPN -PNP, construction, forward and reverse bias characteristics -Early effect, current equations- Input and Output characteristics of CE, CB CC- Ebers Moll Model- Multi Emitter Transistor, Gummel Poon-model.

UNIT 3 FIELD EFFECT TRANSISTORS**9 Hrs.**

JFETs - Drain and Transfer characteristics, -Current Equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage -Channel length modulation, D-MOSFET, E-MOSFET- Characteristics - Comparison of MOSFET with JFET, DUAL GATE MOSFET.

UNIT 4 SPECIAL SEMICONDUCTOR DEVICES**9 Hrs.**

Schottky barrier diode-SCR, DIAC, TRIAC, Varactor diode, Tunnel diode, UJT, LDR, Photo transistor, Gallium Arsenide device.

UNIT 5 POWER DEVICES AND DISPLAY DEVICES**9 Hrs.**

Power BJT- Power MOSFET- DMOS-VMOS, CRO, LASER diode, Operation of LCDs, Plasma, LED, Opto-Coupler, Solar cell, CCD.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Apply the knowledge of basic semiconductor materials and understand fabrication processes.
- CO2 - Analyse the characteristics of various electronic devices like diode, transistor etc.
- CO3 - Classify and analyse the various circuit configurations of Transistor and MOSFETs.
- CO4 - Illustrate the qualitative knowledge of Power electronic Devices.
- CO5 - Become Aware of the latest technological changes in Display Devices.
- CO6 - Apply the knowledge of basic semiconductor materials and understand fabrication processes.

TEXT / REFERENCE BOOKS

1. Donald A Neaman, "Semiconductor Physics and Devices", 4th Edition, Tata McGraw Hill Inc. 2012.
2. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, "Electronic Devices and circuits", 3rd Edition, Tata McGraw Hill, 2008.
3. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press 2012.
4. Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory" Pearson Prentice Hall, 10th Edition, 2008.
5. R.S.Sedha, "A Text Book of Applied Electronics", S.Chand Publications, 2006.
6. Edward S.Yang, "Fundamentals of Semiconductor devices", McGraw Hill International Edition, 1978.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 mark search - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SECA2101	ELECTRONIC DEVICES LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To give a basic introduction to electronic components.
- To provide students knowledge about semiconductor diodes.
- To determine the V-I characteristics of transistor configurations.
- To determine the characteristics of thyristor circuits.
- To explain the importance of transistors as switch.

SUGGESTED LIST OF EXPERIMENTS

1. Study of circuit components and equipments (Component identification, color coding, checking diode, BJT, FET, study of CRO, Audio Oscillator, Multimeter, LCR meter).
2. Characteristics of Semiconductor diode and Zener diode.
3. Characteristics of CE and CB configuration.
4. Characteristics of JFET.
5. Characteristics of SCR & UJT.
6. Characteristics of DIAC & LDR.
7. Clippers and Clampers.
8. Voltage multipliers.
9. Switching Characteristic of BJT.
10. Characteristics of CC configuration.

COURSE OUTCOMES

On completion of the course, students are able to

- CO1 - Understand the basic circuit concepts.
- CO2 - Explain the functioning of transistor configurations.
- CO3 - Demonstrate the understanding of special semiconductor diodes and its applications.
- CO4 - Analyze the V-I characteristics of thyristors.
- CO5 - Determine the performance of switching characteristics of BJT.
- CO6 - Evaluate the various parameters by utilizing oscilloscopes and other modern test equipments.

SCSA1203	DATA STRUCTURES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart the basic concepts of data structures and algorithms.
- To be familiar with writing recursive methods.
- To understand concepts about searching and sorting techniques.
- To implement basic concepts about stacks.
- To apply the concepts of queues and its types.

UNIT 1 INTRODUCTION TO ALGORITHMS**9 Hrs.**

Introduction Data Structures - Need - classification - operations - Abstract data types (ADT) - Array - characteristics - types - storage representations. Array Order Reversal - Array Counting or Histogram - Finding the maximum Number in a Set, Recursion - Towers of Hanoi - Fibonacci series - Factorial.

UNIT 2 LINKED LISTS**9 Hrs.**

Introduction - Singly linked list - Representation of a linked list in memory - Operations on a singly linked list - Merging two singly linked lists into one list - Reversing a singly linked list - Applications of singly linked list to represent polynomial - Advantages and disadvantages of singly linked list - Circular linked list - Doubly linked list - Circular Doubly Linked List.

UNIT 3 STACKS**9 Hrs.**

Basic Stack Operations - Representation of a Stack using Arrays - Algorithm for Stack Operations - Stack Applications: Reversing list - Factorial Calculation - Infix to postfix Transformation - Evaluating Arithmetic Expressions.

UNIT 4 QUEUES**9 Hrs.**

Basic Queue Operations - Representation of a Queue using array - Applications of Queues - Round robin Algorithm - Enqueue - Dequeue - Circular Queues - Priority Queues.

UNIT 5 SEARCHING AND SORTING TECHNIQUES**9 Hrs.**

Basic concepts - List Searches using Linear Search - Binary Search - Fibonacci Search - Sorting Techniques - Insertion sort - Heap sort - Bubble sort - Quick sort - Merge sort - Analysis of sorting techniques.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Understand the concept of recursive algorithms.
- CO2 - Demonstrate the different types of data structures.
- CO3 - Able to understand the operations on linear data structures.
- CO4 - Summarize searching and sorting techniques.
- CO5 - Choose appropriate data structure as applied to specified problem definition.
- CO6 - Understand and implement the applications of linear data structures.

TEXT / REFERENCE BOOKS

- Jean-Paul Tremblay, Paul G. Sorenson, "An Introduction to Data Structures with Application", TMH, 2017.
- Richard F. Gilberg, Forouzan, "Data Structures", Cengage, 2004, 2nd Edition.
- Larry R. Nyhoff, ADTs, "Data Structures, and Problem Solving with C++", Prentice Hall Edition, 2004.
- Thomas H. Cormen, Charles E. Leiserson, "Introduction to Algorithms", 3rd Edition, 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each-No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SCSA2202	PROGRAMMING IN C AND DATA STRUCTURES LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To understand the concepts of Procedure Oriented Programming.
- To handle conditional and Looping Statements in different scenarios.
- To learn and employ concepts of ADTs.
- To apply Linear Data Structures - lists, stacks, and queues in real time applications.
- To apply concepts of Non Linear Data structures namely Trees and Graphs.

SUGGESTED LIST OF EXPERIMENTS

1. Write C statement(s) to produce the following output :
a. Good Morning! b. Welcome ^ C! c. God Bless "You" d. Hello world! (using a single printf statement)
2. Write a C program that calculates the total interest income on amount Rupees 5 lakhs in a period of 10 years. Show the results for simple interest, compound interest when the compounding is done annually, semi-annually, quarterly, monthly and daily. Assume that the interest rate is 3.7% per year.
3. Generate Prime number between 200 and 300.
4. Write a C non-recursive function that accepts two integers and returns -1 if both the integers are zero, otherwise it returns their GCD.
5. Write a C program which does the following:
a. Accepts three integers from the keyboard.
b. Prints out number 1 if any two of them (or all of them) are the same and prints out zero if all of them are different.
6. Following is the Taylor-series expansion for sin(x):
$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$$

Write a program that reads a value of x and calculates sin(x) using the first 10 terms only and prints out the result.
7. Write a C program that accepts a positive integer n from the terminal and then prints out the numbers between 1 and n inclusive which are multiple of 5 but not multiple of.
8. Searching- a) Linear Search b) Binary Search.
9. Sorting a)Bubble Sort, b)Insertion Sort, c)Selection Sort, d)Heap Sort, ,e)Shell sort, f)Quick Sort,g)Merge Sort.
10. Stack operations. 11.Queues operations.12.Singly Linked list.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Demonstrate and implement Procedure Oriented Concepts in any given application.
 CO2 - Ability to handle the control statements and define functions.
 CO3 - Implement abstract data types for linear data structures.
 CO4 - Apply the different linear and non-linear data structures to problem solutions.
 CO5 - Critically analyze the various sorting algorithms.
 CO6 - Understand Stack and Queue operations.

SECA1301	SIGNALS AND SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce the fundamental signals like Step, Ramp, Pulse, Impulse, Exponential, Sinusoidal Signals and its various operation.
- To analyze the continuous time signals by applying the knowledge of Fourier series, Fourier transform and Laplace transform.
- To study the characteristics of continuous time systems and analyze the properties using Fourier series, Fourier transform and Laplace transform.
- To analyze the discrete time signals by applying the knowledge of Discrete Fourier transform and Z transform.
- To study the characteristics of discrete time systems and analyze the properties using Discrete Fourier transform and Z transform.

UNIT 1 INTRODUCTION TO SIGNALS**9 Hrs.**

Signals- Continuous time signals (CT signals) and Discrete time signals (DT signals) -Step, Ramp, Pulse, Impulse, Exponential and Sinusoidal Signal - Basic Operations on signals -Amplitude Scaling, Time Scaling, Time Reversal, Time Shifting, Signal Addition, Subtraction-classification of CT and DT signals-Deterministic and Non-deterministic Signals, Even and Odd Signals, Periodic and Aperiodic Signals, Energy and Power Signals, Real and Imaginary Signals

UNIT 2 ANALYSIS OF CONTINUOUS TIME SIGNALS**9 Hrs.**

Fourier series analysis -Continuous Time Fourier Transform -Properties of CTFT-Inverse Fourier transform- unilateral and bilateral Laplace Transform analysis with examples - Basic properties - Parseval's relation - Convolution in time and frequency domain-Inverse Laplace transform using partial fraction expansion method - Relation between Fourier transform and Laplace transform

UNIT 3 LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS**9 Hrs.**

Continuous time Systems- Classification of systems - Static and dynamic, Linear and non-linear, Time-variant and time-invariant, Causal and non-causal, Stable and unstable -Linear time Invariant System- Frequency response of LTI systems - Analysis and characterization of LTI systems using Laplace transform - Differential equation- Computation of impulse response, step response, natural response, forced response and transfer function using Laplace transform - Convolution integral -Properties of convolution integral.

UNIT 4 ANALYSIS OF DISCRETE TIME SIGNALS**9 Hrs.**

Spectrum of DT signals, Discrete Time Fourier Transform (DTFT)- Properties of DTFT - z-transform -Basic properties of Z transform - Region of convergence - Properties of ROC - Poles and Zeros - Inverse z-transform using Contour integration - Long Division Method, Residue Theorem, Convolution method and Partial fraction expansion-Relation between DTFT and Z transform.

UNIT 5 LINEAR TIME INVARIANT DISCRETE TIME SYSTEMS**9 Hrs.**

Discrete time Systems- Classification of systems - Static and dynamic, Linear and non-linear, Time-variant and time-invariant, Causal and non-causal, Stable and unstable -Linear time Invariant System -Difference equation - Computation of Impulse response, Frequency response, step response, natural response, forced response and Transfer function using Z Transform, Convolution Sum using matrix, graphical and tabulation method-Properties of convolution sum.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Apply various signal operations on different types of CT and DT signals
- CO2- Analyze the characteristics of continuous-time periodic and aperiodic signal using suitable transforms.
- CO3 - Evaluate the input and output relationships of LTI system
- CO4 - Analyze the response of DT systems using various transforms
- CO5 - Analyze the characteristics of various real time signals using appropriate transforms
- CO6 - Derive mathematical model of the systems and signals for the applications

TEXT / REFERENCE BOOKS

1. P.Ramesh Babu et al., "Signals and Systems", 4th Edition, Scitech Publishers, 2017.
2. Rodger E. Ziemer, William H Tranter, D. R. Fannin, "Signals and Systems: Continuous and Discrete", 4th Edition, Pearson Education India, 2014.
3. Haykin S. and Van Been B., "Signals and Systems", 2nd Edition, John Wiley and Sons, 2015.
4. H.P. Hsu, "Signals and Systems", 2nd Edition, Tata McGraw Hill, 2017.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks.****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks.**

B.E. / B.Tech. - Regular

REGUALTIONS 2019

SECA1307	ELECTRONIC CIRCUITS - I	L	T	P	Credits	Total Marks
		3	*	0	3	100

Course Objectives

- To understand the method of biasing transistors.
- To acquire the knowledge of equivalent circuits.
- To understand the frequency response of amplifiers.
- To provide foundation and confidence to the students to troubleshoot and fault analysis of power supplies and power amplifiers.
- To develop current mirrors and differential operations

UNIT I BIASING OF BJT AND FET**9 Hrs.**

BJT- Need for biasing - Various biasing methods of BJT- Bias Circuit Design- DC Load Line - DC analysis of Transistor circuits- AC Load Line- AC analysis of Transistor Circuits- Quiescent Point -Thermal stability - Stability factors - Biasing of JFET - Various biasing methods of JFET - JFET Bias Circuit Design - MOSFET Biasing-Two port network.

UNIT II EQUIVALENT MODELS OF BJT AND FET AMPLIFIERS**9 Hrs.**

Hybrid model- Analysis of CE, CC and CB amplifiers using Hybrid equivalent circuits to obtain gain, input impedance and output impedance- Small Signal Amplifiers - Analysis of CE, CC and CB amplifiers using small signal equivalent circuits to obtain gain, input impedance and output impedance. Small Signal equivalent circuit of FET and MOSFET - Analysis of CS, CD and CG JFET amplifiers using small signal equivalent circuits- Analysis of CS, CD and CG MOSFET amplifiers using small signal equivalent circuits

UNIT III MULTISTAGE AMPLIFIERS AND FREQUENCY RESPONSE OF BJT AND FET AMPLIFIERS**9 Hrs.**

Multistage Amplifiers- Methods of Coupling- RC Coupled- Transformer Coupled - Direct Coupled Amplifiers- Amplifier frequency response - Miller effect- Frequency response of transistor amplifiers with circuit capacitors - BJT frequency response - Low and High frequency analysis of CE, CB, CC - Frequency response of FET - Low and High frequency analysis of CS, CG, CD JFET & MOSFET.

UNIT IV POWER SUPPLIES AND POWER AMPLIFIERS**9 Hrs.**

Linear mode power supply - Rectifiers - Half-Wave Rectifier - Full-Wave Rectifier - Filters- L, C, LC, CLC Filter- Regulators - Zener Diode regulator- Linear series, shunt voltage Regulators - Switched mode power supply (SMPS) - Large Signal Amplifiers - Class A, Class B, Class C, Class D- Distortion in power amplifiers.

UNIT V CURRENT MIRRORS AND DIFFERENTIAL AMPLIFIERS**9 Hrs.**

Current sources for biasing - Current steering circuits - Current mirror with improved performance (Cascode mirror, Wilson, Widlar). Large and small signal operation of Differential pair circuit Differential pair with active load - Frequency response of the Differential amplifier

Max. Hours: 45**Course Outcomes**

On completion of the course, the student should be able to

- CO1 - Design biasing circuits for BJT and FET.
- CO2 - Analyze BJT and FET amplifiers using equivalent circuit models.
- CO3 - Evaluate frequency response of BJT and FET amplifiers in different configurations.
- CO4 - Design multistage amplifiers using BJT
- CO5 - Analyze the performance of power supplies and power amplifiers.
- CO6 - Design current mirrors and differential amplifiers

TEXT / REFERENCE BOOKS

1. Millman J and Halkias C., "Integrated Electronics", TMH, 2nd Edition, 2017.
2. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits", TMH, 2nd Edition, 2017.
3. Adel S. Sedra and Kenneth C. Smith, "Microelectronic Circuits", Oxford University Press, Sixth Edition, 2009.
4. Behzad Razavi, "Fundamentals of Microelectronics", 1st edition, Wiley publication, 2008.
5. Donald. A. Neamen, "Electronic Circuits Analysis and Design", McGraw Hill Education (India) Private Ltd., 3rd Edition, 2010.
6. Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", Pearson Education, 11th Edition, 2013.
7. Floyd, "Electronic Devices", Pearson Education, 9th Edition, 2012.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each-No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SECA1303	ANALOG COMMUNICATION SYSTEMS (For ECE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To discuss and understand fundamental concepts of amplitude modulation and demodulation techniques.
- To understand the concepts of Frequency Modulation and De-Modulation techniques and compare with AM and PM.
- To understand the concepts of Analog Pulse modulation and De-Modulation techniques (PAM, PDM/PWM and PPM) & Multiplexing techniques and classifications.
- To apply different multiplexing techniques for AM, FM, PAM, PWM and PPM systems.
- To understand the various noises and their effect on Analog modulation systems.
- To discuss the working of Analog Communication Receivers and Telephone and Television Systems.

UNIT 1 AMPLITUDE MODULATION AND DEMODULATION**9 Hrs.**

Need for modulation- Model of communication system and classification, Representation of AM - Modulation index and power calculation -Types of AM;DSB-FC: Collector and base modulation circuits, square law modulator- DSB-SC: Balanced modulator circuit using FET - SSB: Filter method and phase shift method - VSB, Comparison of various AM schemes-AM transmitter: Low level and high level Modulation. Demodulation -Envelope detector, Significance of RC time constant- Square law detector.

UNIT 2 ANGLE (FM AND PM) MODULATION AND DEMODULATION**9 Hrs.**

Single tone FM: Mathematical representation, frequency spectrum and bandwidth- Multi-tone FM - NBFM and WBFM - Phase modulation (PM): Mathematical representation - Conversion: FM to PM and PM to FM - Comparison of AM, FM and PM- FM Generation: Direct method using Varactor diode and indirect method (Armstrong modulator) - Pre-emphasis - FM transmitter. FM Detector: Balanced slope detector, Foster seeley frequency discriminator and Ratio detector - De- emphasis.

UNIT 3 ANALOG PULSE MODULATION AND MULTIPLEXING**9 Hrs.**

Sampling theorem - Types of sampling-Concepts of PAM, PWM, PPM and PCM- Modulators and demodulators. Types of Multiplexing- Frequency Division Multiplexing, Time Division Multiplexing and Quadrature Multiplexing - Comparison of multiplexing.

UNIT 4 ANALOG RECEIVERS AND NOISE**9 Hrs.**

AM Receivers: TRF receivers -Super heterodyne receivers - FM Receivers: FM stereo broadcast receivers - AFC - Capture effect, FM threshold effect. Communication Receivers: Sensitivity, fidelity and selectivity - Squelch circuit - Beat frequency Oscillator-Types of Noise- Noise factor and noise temperature for cascaded amplifier (Friis formula)- Noise in AM and FM systems.

UNIT 5 COMMUNICATION SYSTEMS**9 Hrs.**

Telephone Systems-Electronics Telephone and cellular Telephone System - Fax-Television Systems-Scanning-camera tube and Transmitter, Picture tube and Receiver, CCTV and Set top box.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Analyze the performance of continuous wave modulation techniques
- CO2-Design modulator and the demodulator circuits for different analog modulation techniques
- CO3-Develop system level model of transceivers for analog communication systems
- CO4-Evaluate the impact of noise in AM and FM systems communication receivers
- CO5-Develop appropriate modulation techniques for a transmission of real time signals
- CO6-Develop suitable multiplexing techniques for spectrum Optimization in communication systems

TEXT/REFERENCE BOOKS

1. R.P Singh Sanjay Sharma, "Analog Communication Systems", 2009.
2. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press, 2007.
3. Deshpande, N.D, "Communication Electronics", Tata McGraw Hill Publishers,1989.
4. Louis. E. Frenzel, "Communication Electronics Principles and applications", 3rd Edition, Tata Mc.Graw Hill, 2002.
5. Dennis Reddy and John Coolen, "Electronic Communications", 4th Edition, Prentice Hall Publishers,1995.
6. Kennedy, "Electronic Communications Systems", 4th Edition, McGraw-Hill Publishers,1992.
7. R.Gulati, "Monochrome and colour television", 2nd Edition, New age international 2005.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 10 Questions of 2 marks each - No choice**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**Exam Duration: 3 Hrs.****20 Marks****80 Marks**

SECA2301	CIRCUITS AND NETWORKS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To construct a KCL & KVL circuits.
- To design the Constant K filters and M-Derived filters.
- To design the Attenuators and equalizer circuits.
- To verify the twin T network circuits.
- To verify reciprocity theorem and compensation theorem.

SUGGESTED LIST OF EXPERIMENTS

1. Verification of KCL & KVL.
2. Verification of Thevenin's & Norton's Theorem.
3. Series and Parallel Resonance.
4. Constant K filters (both LPF & HPF).
5. M-Derived filters (both LPF & HPF).
6. Attenuators.
7. Equalizers.
8. Matching Networks.
9. Twin T Network as Notch filter.
10. Verification of reciprocity theorem.
11. Verification of compensation theorem.
12. Study of composite m-derived filters.

COURSE OUTCOMES

On completion of the course, students are able to

- CO1-Apply the basic Electrical Laws for verifying them by feeding different excitation for the circuit.
- CO2-Design the different filter circuits.
- CO3-Determine the performance of Attenuators and equalizer circuits.
- CO4-Analyze the twin T network circuits.
- CO5-Determine the bandwidth, selectivity, Q-factor for a series and parallel resonance circuits
- CO6-Solve the electrical networks by implementing network theorems

SECA2302	ELECTRONIC CIRCUITS - I LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To construct a biasing circuits.
- To design the rectifier circuits.
- To design the voltage regulator circuits.
- To design the digital circuits.
- To design the circuits using PSPICE.

SUGGESTED LIST OF EXPERIMENTS

1. Transistor Biasing Circuits.
2. Half wave Rectifier With and Without Filter.
3. Voltage Regulator.
4. Fullwave Rectifier With and Without Filter, Flipflops using PSPICE.
5. Adders.
6. Subtractors.
7. Shift Register.
8. Counters.
9. Code Converters.
10. Common Source JFET, Common Emitter BJT using PSPICE.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1-Determine the biasing circuits of transistors.
- CO2-Design the different rectifier circuits.
- CO3-Experiment with the voltage regulator circuits.
- CO4-Analyze the digital circuit's performance.
- CO5-Assess the digital circuits using PSPICE.
- CO6-Evaluate the analog circuits using PSPICE.

S13ADPROJ	Design Thinking	L	T	P	Credits	Total Marks
		0	0	4	2	100

Course Objectives

- To introduce the concept of Design thinking to solve Real World Problems
- To understand the process of design thinking
- To identify and analyze societal issues
- To provide solution to the identified Real World Problem

UNIT I INTRODUCTION AND COGITATION**9 Hrs**

Introduction to design thinking- Johari Window – Persona - DCAFE and VAL. – Theory of prioritization – Brain storming - 25 brainstorming techniques, Case Study - Identification of Real-World Problems using brain storming and assigning priorities. Discussion on case study. Activities: Formation of team – Brain storming – Case study

UNIT II DESIGN THINKING PROCESS**9 Hrs**

Elements of great design - Human element of design thinking – Lateral thinking – HOTS – Out of box thinking - case study Problem Identification – Identification of a specific Real Word Problem after brain storming – Team Presentation on identified problem. Activities: Specific Problem selection to proceed with the work – Team presentation on identified problems and various possible solutions.

UNIT III ENGINEERING DESIGN - PHASE 1**9 Hrs**

Identification of stake holders – Roles and responsibilities – Conduct of surveys and interviews for addressing Real World Problems – Literature Surveys - Data collection. Surveys: Stake holder Survey – Literature Survey – Presentation on Stake holder's survey and Literature survey. Activities: SWOT Analysis – Finalize the identified problem

UNIT IV ENGINEERING DESIGN - PHASE 2**9 Hrs**

Difference between Creativity and Innovation – Examples of innovation – Overcoming obstacles – Decision making on implementation of identified problem – Identifying evaluation criteria - Functional decomposition. Documentation: Functional decomposition diagram, Decision on implementation, Evaluation criteria. Activities: Documentation

UNIT V ENGINEERING DESIGN - PHASE 3**9 Hrs**

Brain storming alternate solutions- Developing proof of concept Project: Poster presentation and Proof of concept display Activities: Development of POC

Course Outcomes

On completion of the course, the student will be able to

- CO 1 – Comprehend the various types of thinking skills.
- CO 2 - Explain the innovative and creative ideas.
- CO 3 – Apply engineering design process for the identified problem
- CO 4 - Analyze a suitable solution for socially relevant issues
- CO 5 – Develop working structure and concepts for the identified problem
- CO 6 - Design solutions for Real World Problem.

Text/Reference Books

1. How to have Creative Ideas, Edward deBono, Vermilion publication, UK, 2007
2. The Art of Innovation, Tom Kelley & Jonathan Littman, Profile Books Ltd, UK, 2008
3. G.Pahl and W.Beitz (Translated by Ken Wallace et al.), „Engineering Design: A Systematic Approach, Second Edition, Springer, 2005.
4. George E. Dieter and Linda C. Schmidt, “Engineering Design”, Fourth Edition, McGraw Hill Higher Education, 2009.
5. Power Point Presentation material by Prof.D.K.Subramanian in the Workshop on Engineering Design at TCE, Madurai. Foundation Skills in Integrated Product Development, NASSCOM, Edition 2015.

SECA1401	ELECTRONIC CIRCUITS - II	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand the concepts of Feedback amplifiers.
- To identify the design and analysis of Oscillators.
- Be familiar with the performance of Tuned Amplifiers.
- Learn the types of Multivibrators.
- To focus on Time Based Generator and Blocking Oscillator.

UNIT 1 FEEDBACK AMPLIFIERS**9 Hrs.**

General feedback structure-Types of feedback - Properties of negative feedback - Basic feedback Topologies - Feedback amplifiers - effect of feedback amplifier on noise, distortion, gain, input and output impedance, analysis of voltage and current feedback amplifier.

UNIT 2 OSCILLATORS**9 Hrs.**

Barkhausen Criterion for Oscillator - General form of Oscillator -Classification of Oscillator - Sinusoidal Oscillator - RC Phase Shift Oscillator and Wein Bridge Oscillator - Analysis of LC Oscillator- Hartley- Colpitts- Clapp- Armstrong-Crystal Oscillator.

UNIT 3 TUNED AMPLIFIERS**9 Hrs.**

Resonance Circuits, Unloaded and Loaded Q of Tank Circuit - Bandwidth - Types of Tuned Amplifiers - Analysis of Single Tuned Amplifier - Double Tuned Amplifier-Stagger Tuned Amplifier - Instability of Tuned Amplifier - Stabilization Techniques, Neutralization and Unilaterization - Class C Tuned Amplifiers .

UNIT 4 WAVE SHAPING AND MULTIVIBRATOR CIRCUITS**9 Hrs.**

High Pass and Low Pass RC Circuits and their Response for Sine, Step, Pulse, Square, Ramp and Exponential Input - Multivibrators - Astable Multivibrators - Emitter and Collector Coupled - Monostable Multivibrators, Bistable Multivibrators, and Schmitt Trigger Circuits.

UNIT 5 TIME BASED GENERATOR AND BLOCKING OSCILLATORS**9 Hrs.**

Principle of Time Based Generator - Types of Time Based Generator - Voltage Time Based Generator - Bootstrapped and Miller Saw Tooth Generator - Current time Based Generator - Blocking Oscillator - Monostable and Astable Blocking Oscillator using Emitter and base Timing - Push-Pull Operation of Blocking Oscillator.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Analyze the types of feedback Amplifiers
- CO2-Analyze the frequency of oscillation of oscillators
- CO3-Analyze the performance of Tuned Amplifiers by measuring the gain and bandwidth
- CO4-Analyze the wave shaping and multivibrator circuits
- CO5-Examine the Time Based Generator
- CO6-Examine the different types of Blocking Oscillators

TEXT / REFERENCE BOOKS

1. Christos C. Halkias, Satyabrata Jit, Jacob Millman Millmans , "Electronic Devices and Circuits" 4th Edition 2015.
2. Sedra and Smith, "Microelectronic Circuits", Oxford University Press, 6th Edition, 2010,
3. BOGART, " Electronic Devices and Circuits", Pearson - 2011",
4. Milmam and Halkias, "Integrated Electronics", TMH, 2017.
5. Balbir Kumar and Shail B. Jain, " Electronic Devices and Circuits", Kindle eBook 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks.****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks.**

SECA1402	TRANSMISSION LINES AND WAVE GUIDES	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand the concept of transmission lines types, various line parameters, waveguide types and resonators.
- To Characterize and analyze the transmission line parameters and Acquire knowledge about the waveguides and resonators.
- To analyze transmission lines for various frequencies and also smith-charts.

UNIT 1 TRANSMISSION LINE THEORY**9 Hrs.**

Introduction - Types of transmission lines - General theory of transmission line - Line constants - Transmission line equation - Physical significance of the equations - The Infinite line - Distortion in a line - Distortionless line - Telephone cables - Loading of lines - Types of loading - Campbell's formula - General equation for line with any termination - Input impedance - Open and Short circuited line. Numerical problems.

UNIT 2 RADIO FREQUENCY TRANSMISSION LINES**9 Hrs.**

Line approximations - Parameters of open wire line at radio frequency, parameters of coaxial lines at radio frequencies, constants for the line of zero dissipation - Voltages and Currents on the dissipation-less lines - input impedance of a lossless line - Wavelength and velocity of propagation - Reflection phenomena - Line losses - Return loss - reflection loss- insertion loss.- Reflection coefficient, Reflection factor, Standing wave ratio, Input impedance in terms of reflection coefficient - Practical types - Microwave Transmission line, Super Conducting transmission line, Characteristics of different printed transmission lines.

UNIT 3 MATCHING, MEASUREMENTS AND INTERFERENCES**9 Hrs.**

Types of transmission line sections - Half wave line - One eighth wave line - Quarter wave line - Properties of quarter wave transformer - Location of V_{max} and V_{min} - Impedance matching - Single and double stub matching- Smith chart - Solutions of problems using smith chart - Applications of smith chart - Measurement of line parameters- Measurement of VSWR, Wavelength, Impedance and Power - Phenomenon of corona, Methods of reducing corona and interference.

UNIT 4 ELECTROMAGNETIC WAVES**9 Hrs.**

Waves between parallel planes - Transverse electric waves - Transverse magnetic waves - Characteristics of TE and TM waves - Transverse electromagnetic waves - Velocities of propagation - Attenuation in parallel plane waves - Wave impedance.

UNIT 5 GUIDED WAVES AND WAVE GUIDE THEORY (QUALITATIVE TREATMENT ONLY).**9 Hrs.**

Rectangular wave guides - TE and TM waves in rectangular wave guides - Dominant mode - Cut off frequency in wave guides - Impossibility of TEM waves in wave guides - Circular wave guides- TE and TM waves in circular wave guides - Attenuation factor and Q of wave guides- Microwave resonators introduction - rectangular cavity resonator - Q-factor of micro wave cavities.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Apply the knowledge of fundamental concepts of wave propagation in Transmission Lines and Wave Guides
- CO2-Analyze the line parameters and various losses in transmission lines
- CO3-Design line parameter and impedance calculations using smith chart
- CO4-Evaluate the characteristics of parallel plane and rectangular wave guides
- CO5-Evaluate the characteristics of Circular waveguides and prioritize their usage
- CO6-Correlate the characteristics of resonators

TEXT / REFERENCE BOOKS

1. Edward Jordan and K.G.Balmain, "Electromagnetic waves and radiating system", 4th Edition, PHI, 2016.
2. Umeshsinha, "Transmission lines and networks", 8th Edition, Sathya Prakashan Publishers, 2010
3. John D. Ryder, "Network lines and fields", 4th Edition, Prentice Hall of India, 2010.
4. Samuel Y. Liao, "Microwave devices and circuits", 3rd Edition, Prentice Hall of India, 2003.
5. David M.Pozar, "Microwave Engineering", 3rd Edition, John Wiley, 2011.
6. Seth S.P., "Elements of Electromagnetic Fields", 2nd Edition, Dhanpat Rai and Sons, 2007.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks.****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks.**

SECA1403	DIGITAL COMMUNICATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To know the principles of sampling & quantization.
- To understand the various Base Band signaling schemes.
- To introduce the basic concepts of digital modulation of baseband signals.
- To get introduced to the basics of source and channel coding/decoding.
- To understand the basics of spread spectrum modulation schemes.

UNIT 1 SAMPLING AND QUANTIZATION**9 Hrs.**

Digital communication systems: performance metrics and specifications-Review of Sampling process -Natural Sampling-Flat Sampling - Aliasing - Signal Reconstruction-Quantization- Uniform & non-uniform quantization - quantization noise - PCM- Noise considerations in PCM- differential pulse code modulation - Delta modulation - - Adaptive Delta Modulation.

UNIT 2 BASEBAND PULSE TRANSMISSION**9 Hrs.**

Base band transmission - Wave form representation of binary digits -Matched Filter- Error Rate due to noise - Nyquist's criterion for Distortion less Base band Binary Transmission- Inter symbol Interference - Ideal Nyquist channel - Raised cosine channels- Correlative level coding - Equalization- Adaptive Equalization - Eye patterns- Companding - correlation receiver.

UNIT 3 DIGITAL MODULATION TECHNIQUES**9 Hrs.**

Introduction - ASK- FSK - PSK- coherent modulation techniques-BFSK-BPSK-signal space diagram-probability of error- Coherent Quadrature modulation techniques- QPSK-signal space diagram-probability of error- Non coherent modulation techniques-DPSK-M-ary modulation techniques - Vectorial view of MPSK.

UNIT 4 ERROR CONTROL CODING**9 Hrs.**

Discrete memoryless channels - Linear block codes - Cyclic codes - Convolutional codes - Maximum likelihood decoding of convolutional codes-Viterbi Algorithm, Trellis coded Modulation, Turbo codes.

UNIT 5 SPREAD SPECTRUM MODULATION**9 Hrs.**

Pseudo- noise sequences - a notion of spread spectrum - Direct sequence spread spectrum with coherent binary phase shift keying - Signal space Dimensionality and processing gain -Probability of error - Frequency -hop spread spectrum- Synchronization and its types.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

CO1-Apply the knowledge of signals and systems to compute noise levels and bandwidth requirements for different binary encoding schemes.

CO2-Evaluate the performance of baseband communication systems in the presence of noise and inter-symbol interference

CO3-Analyze bit-error rate and spectral requirements of different band-pass signaling schemes.

CO4-Design encoder and decoder architecture for error control codes like Hamming code, Convolutional Code,etc.

CO5-Analyze the performance of digital communication systems with spread spectrum techniques.

CO6-Examine the theoretical concepts through application of modern software tools.

TEXT/REFERENCE BOOKS

1. Simon Haykins, "Communication Systems" John Wiley, 5th Edition, March 2009.
2. Taub. HDL Schilling, G Saha, "Principles of Communication", 5th Edition,2009.
3. John G. Proakis, Masoud Salehi, "Digital Communication", McGraw Hill, 5th Edition,2007.
4. Bernard Sklar, "Digital Communication, Fundamentals and Application", Pearson Education Asia, 2nd Edition,2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks.****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks.**

SAIC4001	INDUSTRY 4.0	L	T	P	Credits	Total Marks
		2	0	0	2	100

UNIT 1 ADVANCED TECHNOLOGY AND MATERIALS**7 Hrs.**

Advanced electro-optical sensing technology-active, passive multi-spectral and hyper spectral imaging; electronic beam steering; vacuum technology, surface and coating technology, health care technology, Nanotechnology- Nanomechanics, Nano optoelectronics; energy storage technology-next generation Li-based Batteries, Hydrogen storage, solar photovoltaic's, Flexible electronics. Intellectual Property Rights - case studies governing/pertaining to Materials/Technology.

UNIT 2 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING**7 Hrs.**

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics - Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Case studies - Intellectual Property rights infringement in Biology.

UNIT 3 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT**7 Hrs.**

Introduction - Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) - Unmanned Aerial Vehicles, sensors - Additive manufacturing in construction - Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal, public health issues-improving water management in surface and overhead irrigation- Integration of energy, water and environmental systems for a sustainable development.

UNIT 4 SMART MANUFACTURING**8 Hrs.**

Smart factories and interconnection, Smart Manufacturing - automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self propelled vehicles, e mobility, Green fuels, drones - unmanned aerial vehicles(UAVs), aerodynamics. Robotic Automation and Collaborative Robots - Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies - Frugal Innovations - Intellectual Property Rights (IPR): Case Studies.

UNIT 5 SMART WORLD**8 Hrs.**

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Intellectual Property Rights- Case Studies.

UNIT 6 CYBER PHYSICAL SYSTEMS**8 Hrs.**

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR) : Case Studies.

Max. 45 Hrs.**TEXT / REFERENCE BOOKS**

1. William D. Callister, "Materials Science and Engineering, An Introduction", John Wiley and Sons Inc. Singapore, 2001.
2. V. Raghavan, "Physical Metallurgy: Principle and Practice", Prentice Hall India Pvt Ltd, 2006.
3. Flavio Craveiro, Jose Pinto Duarte, Helena Bartolo and Paulo Jorge Bartolo, "Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0", Automation in Construction, Vol. 103, pp. 251-267, 2019.
3. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
4. Oliver Grunow, "SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies", Studylab Publications, 2016.
5. Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 11 Questions of 2 marks each-No choice**PART B:** 2 Questions from each unit with internal choice; each carrying 13 marks**Exam Duration: 3 Hrs.****22 Marks****78 Marks**

SECA2401	ELECTRONIC CIRCUITS - II LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To construct the amplifier circuits.
- To design the oscillator circuits.
- To design the feedback amplifier circuits.
- To design the importance of digital circuits.
- To design the importance of PSPICE.

SUGGESTED LIST OF EXPERIMENTS

- 1 Class C Power Amplifier using PSPICE.
- 2 Cascode Amplifier.
- 3 Single tuned Amplifier.
- 4 Feed back Amplifier using PSPICE.
- 5 Hartley Oscillator.
- 6 Colpitts Oscillator.
- 7 Waveform generation using CMOS gates.
- 8 PRBS generator.
- 9 Encoders.
- 10 Decoders using PSPICE.
- 11 Multiplexers.
- 12 Demultiplexers using PSPICE.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1-Design the different types of amplifier circuits.
- CO2-Design the oscillator circuits.
- CO3-Analyze the frequency response of feedback amplifier circuits.
- CO4-Design digital logic circuits for given applications
- CO5-Analyze the digital circuits using PSPICE.
- CO6-Evaluate the analog circuits using PSPICE.

SECA1506	DIGITAL SIGNAL PROCESSING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To introduce the fundamental operations of Digital signal processor and its advantages over Analog signal processor.
- To analyze the discrete system using Discrete Fourier Transform and Fast Fourier Transform.
- To design the digital IIR and FIR filter circuit using various techniques.
- To analyze the effect of finite word length register used in the signal processing equipment.
- To introduce the multirate signal processing techniques and its applications.

UNIT 1 DISCRETE FOURIER TRANSFORM (DFT) AND FAST FOURIER TRANSFORM (FFT) 9 Hrs.

Review of Signals and Systems, DFT and its properties, Relation between DTFT and DFT, FFT computations using Decimation in time (DIT) algorithms and Decimation in frequency (DIF) algorithms, Auto correlation, Cross correlation, and their properties. Realization of Discrete Time System: introduction, Basic Realization block diagram and the signal flow graph, Realization of recursive and nonrecursive systems - Direct Form I and Form II - Cascade and parallel realization

UNIT 2 DIGITAL FILTER DESIGN 9 Hrs.

Design of Digital Filters: General considerations: causality and its implications, characteristics of practical frequency selective filter. Design of FIR filter using window method - Rectangular, Hanning and Hamming Windows. Design of IIR filters using Impulse invariant and Bilinear transformation method. Review of Butterworth and Chebyshev approximations, Frequency selective filters: Ideal filter characteristics, low pass, high pass and band pass filters, Properties of IIR and FIR filters.

UNIT 3 FINITE WORD LENGTH EFFECTS 9 Hrs.

Fixed point and floating point number representations - Comparison - Truncation and Rounding errors - Quantization noise - derivation for quantization noise power - coefficient quantization error - Product quantization error - Overflow error - Round off noise power - limit cycle oscillations due to product round off and overflow errors - signal scaling

UNIT 4 MULTIRATE SIGNAL PROCESSING 9 Hrs.

Introduction to Multirate signal processing-Decimation-Interpolation- Polyphase implementation of FIR filters for interpolator and decimator -Multistage implementation of sampling rate conversion- Applications of Multirate signal processing, Speech compression, Adaptive filter, Musical sound processing, Image enhancement.

UNIT 5 REAL TIME DIGITAL SIGNAL PROCESSING 9 Hrs.

Real Time DSP System Architecture and Functional Blocks, Analog Interface, Signal Conditioning, generation and detection for real time applications, - DSP Hardware (Digital Signal Processor, FPGA, ARM Processor with DSP Extension) & its applications- Speech Signal Processing, Enhancements, Coding & Transcoding Techniques (A-Law, U-Law, G.711, G.723, G.729, GSM) for IP and Mobile Telephone applications - High Definition Audio Signal Processing, Audio Coding Techniques and Comparison Analysis, Transcoding. Case Study: A study of an intelligent ECG Monitor.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Analyze LTI Discrete Time Systems using DFT and FFT
- CO2 - Design of digital filters like FIR and IIR Filter
- CO3 - Evaluate the effect of finite word length while designing a digital filter
- CO4 - Employ signal processing strategies in multirate signal processing
- CO5 - Apply the signal processing technique in speech signal and image processing
- CO6 - Build filter design algorithm in DSP processor

TEXT / REFERENCE BOOKS

- John C. Proakis & Dimitrios G. Manolakis, "Digital Signal Processing, Algorithm and Applications", 4th Edition, PHI, 2014.
- Ramesh Babu, "Digital Signal Processing", 6th Edition, SciTech Publications (India) Pvt Ltd, 2014.
- Salivahanan, "Digital Signal Processing", 3rd Edition, McGraw Hill Education, 2017.
- Richard G. Lyons, "Understanding Digital Signal Processing". Second Edition, Pearson Education, 3rd Edition, 2011.
- A.V.Oppenheim, R.W. Schaffer and J.R. Buck, "Discrete-Time Signal Processing", Pearson Education India; 3rd Edition, 2015.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 10 Questions of 2 marks each - No choice**PART B :** 2 Questions from each unit of internal choice; each carrying 16 marks**Exam Duration: 3 Hrs.****20 Marks****80 Marks**

SECA1502	ANALOG INTEGRATED CIRCUITS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To have thorough understanding of Op-Amp.
- To be able to design circuits using op amp for various applications.
- To acquire knowledge about ADC and DAC.
- To study the basic principles of PLL and Timer Circuit.
- To understand the concept of Special function ICs.

UNIT 1 INTRODUCTION TO OP- AMP AND ITS APPLICATIONS.**9 Hrs.**

OP-AMP- DC and AC Characteristics- Input offset voltage- Input bias current-Input offset current- Total output offset voltage- Thermal drift- Slew rate- CMRR -Inverting amplifier- Non-inverting amplifier- Voltage follower- Summing and differential amplifier- Integrator- Differentiator- Logarithmic and Anti logarithmic amplifiers-Comparator and Schmitt trigger.

UNIT 2 FILTERS AND SIGNAL GENERATORS**9 Hrs.**

First order and Second order Butterworth filters- low pass, high pass, band pass and band reject filters -RC phase shift, Wein's bridge oscillator- Astable and Monostable multivibrator-Precision half wave and full wave rectifiers.

UNIT 3 A/D AND D/A CONVERTERS**9 Hrs.**

Sample and Hold circuit - Digital to analog converters: R-2R ladder network and Binary weighted - Characteristics of D/A converters - Analog to digital converters: Flash converter - Successive approximation converter - Dual slope ADC-Weighted-Capacitor DACs- Oversampling Converters.

UNIT 4 PLL AND TIMER CIRCUITS.**9 Hrs.**

Phase Locked Loop IC 565- Block schematic - Applications of PLL: FM demodulator and Frequency synthesizers Demodulator- VCO IC LM 566 - Timer IC LM 555 and its applications: Astable and Monostable multivibrator.

UNIT 5 SPECIAL FUNCTION ICs**9 Hrs.**

Integrated circuit Tuned amplifier, Instrumentation Amplifier, Monolithic voltage regulators 78XX,79XX Series ,Opto coupler, CMOS Operational Amplifier- Dc analysis- small signal analysis- specifications of IC MC 14573.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Analyze the impact of DC and AC characteristics of operational amplifiers on output and their compensation techniques.
- CO2-Design the linear and non-linear circuits with op-amp for specific applications
- CO3-Design filters and various amplifiers circuits for Real World Problems
- CO4-Evaluate the performance of op-amp and IC 555 multivibrators
- CO5-Design data converters for interfacing sensors with electronic circuits
- CO6-Develop op-amp based circuits for resolving problems in communication adhering to standards

TEXT / REFERENCE BOOKS

1. Ramakant A.Gayakwad, "OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education, 2015.
2. D.RoyChoudary, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2000.
3. Grey and Meyer, "Analysis and Design of Analog Integrated Circuits", 4th Edition, Wiley International, 2001.
4. Michael Jacob, "Applications and Design with Analog Integrated Circuits", 2nd Edition, Prentice Hall of India, 1993.
5. S. Salivahanan, V.S. Kanchana Bhaaskaran, "Linear integrated circuits", 3rd Edition, McGraw-Hill, 2011.
6. William D.Stanely, "Operational Amplifiers with Linear Integrated Circuits", 4th Edition, Pearson Education, 2004.
6. Sergio Franco "Design With Operational Amplifiers and Analog Integrated Circuits" 4th Edition, McGraw-Hill Education, 2015.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SECA1503	CMOS VLSI DESIGN	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To focus on basics of semiconductor physics, Predominant CMOS technology.
- To study challenges of digital VLSI design.
- To get an idea about combinational logic circuit using CMOS logic style.
- To acquire the knowledge about sequential logic circuit and subsystem design.
- To extract the backend VLSI algorithms for ASIC.

UNIT 1 MOS TRANSISTOR THEORY**9 Hrs.**

The MOS transistor-Current Voltage Relations-Threshold Voltage-Second order effects-Capacitances in MOSFET - Scaling of MOS circuits -Review of CMOS - DC characteristics - Dynamic behavior- Power consumption.

UNIT 2 COMBINATIONAL LOGIC DESIGN**9 Hrs.**

nMOS depletion load and Static CMOS design - Determination of Pull-up and Pull-down ratio-Design of Logic gates- Sizing of transistors -Stick diagrams-Lay out diagram for static CMOS - Pass transistor logic - Dynamic CMOS design - Noise considerations - Domino logic, np CMOS logic - Power consumption in CMOS gates - Multiplexers - Transmission gates design.

UNIT 3 SEQUENTIAL LOGIC DESIGN**9 Hrs.**

Introduction - Static sequential circuits- CMOS static flip-flop - Dynamic sequential circuits -Pseudo static latch- Dynamic two phase flip-flop - clocked CMOS logic - Pipelining - NORA CMOS logic -True single phase clocked logic - Realization of D-FF in TSPC logic.

UNIT 4 SUBSYSTEM DESIGN**9 Hrs.**

Introduction-Designing Static and Dynamic Adder circuits - The Array Multiplier - Multiplier structures-Baugh-Wooly - Booth Multiplier - Barrel shifter - Memory structures - SRAM and DRAM design - Design approach of Programmable logic devices - PLA,PAL and FPGA.

UNIT 5 BASIC CONSTRUCTION**9 Hrs.**

Physical design - Goals and Objectives - Partitioning methods - Kernighan Lin algorithm - Hierarchical Floor planning - Floor planning tools -input, output and power planning -Min-cut placement, Force directed placement algorithm -Placement using simulated annealing - Greedy channel routing.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, students are able to

- CO1-Apply voltage and current relationship of MOS transistors for obtaining DC characteristics and AC small signal models of CMOS inverter
- CO2-Analyze the different styles of CMOS logic for combinational logic circuit design
- CO3-Design the CMOS static and dynamic sequential logic circuits
- CO4-Evaluate the CMOS subsystems and memory structure designs
- CO5-Construct logic circuits for realization of Boolean expressions using programmable logic devices
- CO6-Develop suitable algorithms for backend VLSI design.

TEXT / REFERENCE BOOKS

1. Jan M.Rabaey, "Digital Integrated Circuits", 2nd Edition, September, PHI Ltd.2000.
2. M.J.S.Smith, "Application Specific Integrated Circuits", 1st Edition, Pearson education.1997.
3. Douglas A.Pucknell,"Basic VLSI design", PHI Limited, 1998.
4. E.Fabricious, "Introduction to VLSI design", McGraw Hill Limited, 1990.
5. Neil Weste, "Principles of CMOS VLSI design", Addison Wesley 1998.
6. Wayne Wolf,"Modern VLSI design", 2nd Edition, Pearson education.2003.
7. Sung-Mo Kang and Yusuf, "CMOS Digital Integrated Circuits- Analysis and Design", 2nd Edition, MGH.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****PART A:** 10 Questions of 2 marks each-No choice**PART B:** 2 Questions from each unit of internal choice; each carrying 12 marks**Exam Duration: 3 Hrs.****20 Marks****80 Marks**

SECA1505	ANTENNAS AND WAVE PROPAGATION	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand the radiation mechanism of different antennas, their parameters and design aspects.
- To learn about antenna arrays and their radiation pattern.
- To learn about travelling wave and broadband antennas.
- To understand electromagnetic wave propagation over ground and through different layers of atmosphere.
- To learn about Smart Antennas

UNIT 1 ANTENNA FUNDAMENTALS AND WIRE ANTENNAS**9 Hrs.**

Antenna Radiation Mechanism - Isotropic radiator- Antenna parameters : Radiation Intensity, Radiation pattern, Gain and Directivity, FBR, Effective Length, Radiation Resistance, Antenna Impedance, Polarization, Beam width, Bandwidth, Antenna temperature- Friis transmission formula. Retarded Potential - Wire Antennas: Short Electric Dipole, Radiation from an alternating current element, Half - wave Dipole, quarter wave monopole - Fields, Power radiated and Radiation Resistance

UNIT 2 ANTENNA ARRAYS**9 Hrs.**

Types of arrays - Broad side, End fire, Collinear, Parasitic arrays. -Arrays of two point sources - N-element of uniform linear arrays - Array of N elements with equal spacing and currents equal in magnitude and spacing (broad side array)- Array of N elements with equal spacing and currents equal in magnitude but with progressive phase shift (end fire array)- Hansen-Woodyard array - Pattern Multiplication - Binomial arrays.

UNIT 3 TRAVELLING WAVE AND BROADBAND ANTENNAS**9 Hrs.**

Travelling wave radiators: basic concepts, Long wire antennas - field strength calculations and patterns - V-antennas, Rhombic Antennas, Small Loop antennas- Concept of short magnetic dipole, Helical Antennas, Folded Dipole Yagi-Uda Arrays, Log periodic antennas. Reflector Antennas: Huygens' principle - Flat Sheet and Corner Reflectors, Paraboloid Reflectors, Cassegrain Feeds. Slot antennas - Babinet's principle, Horn antennas, Lens antennas, Microstrip antennas..

UNIT 4 WAVE PROPAGATION**9 Hrs.**

Factors involved in the propagation of Radio Waves - Ground wave propagation, Structure of Ionosphere and its effects on radio waves- Refraction and Reflection of sky wave by the ionosphere, Ray paths-Measures of Ionosphere propagation: critical frequency, skip distance, virtual height, Maximum usable frequency, Fading of signals: Selective fading - Diversity reception, Space wave propagation-Considerations in space wave propagation, Atmospheric effects in space wave propagation, Super Refraction - Duct Wave Propagation.

UNIT 5 SMART ANTENNAS**9 Hrs.**

Concepts and Benefits of Smart antennas - Fixed weight beamforming- Adaptive beamforming - Design of Planar array antennas for Beamforming applications - Feed techniques for Planar arrays - Role of Smart Antennas in Green Communications and 5G wireless communications -Software Tools for Antenna Design and Analysis

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Define the antenna basic parameters.
- CO2 - Explain the radiation mechanism from the dipole elements.
- CO3 - Classify antenna arrays and infer their significance.
- CO4 - Analyze the characteristics of low and high frequency antennas.
- CO5 - Compare the properties and measures of various radio wave propagation.
- CO6 - Perform antenna measurements and analyze the parameters and develop the basic skills for designing practical antennas.

TEXT / REFERENCE BOOKS

1. John D. Kraus, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation", 5th Edition, McGraw Hill, 2017.
2. Balanis, C.A., "Antenna Theory and Design", 4th Edition, John Wiley and Sons, 2016.
3. Mohammad Abdul Matin, "Wideband, Multiband and Smart Antenna Systems, 1st Edition, Springer, 2021.
4. R.L. Yadava, "Antennas and Wave Propagation", 2nd Edition, PHI Learning Private Limited, New Delhi, 2011.
5. Jordan, E.C and Balmain K.G, "Electromagnetic Waves and Radiating Systems", 2nd Edition, Prentice Hall of India, 2006.
6. K.D.Prasad and Satya Prakasan, "Antennas and Wave Propagation", 3rd Edition, Tech India, New Delhi, 2003

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SECA 2501	DIGITAL SIGNAL PROCESSING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To provide knowledge for understanding of digital signal processing through hands-on experience that is sufficient to enable them to apply DSP to real-world problems.
- To understand the process of convolution, correlation, DFT, IDFT, Signal smoothing, filtering of long duration signals, and Spectral analysis of signals.

SUGGESTED LIST OF EXPERIMENTS

1. Study of ADSP 21XX & TMS 320 C XX processor.
2. Generation of Periodic Signals.
3. Generation of Non Periodic Signals.
4. Sampling.
5. Modulation and Demodulation using Matlab.
6. Computation of Z Transform & Inverse Z transform.
7. Computation of Impulse & System Response.
8. Design of FIR filters using Windowing Techniques.
9. Design of IIR filters using Bilinear Transformation.
10. Spectral Analysis using Matlab.
11. Implementation of FFT using DIT and DIF algorithm.
12. Convolution (Linear and Circular).
13. Correlation (Auto & Cross).
14. Frequency response of first and second order systems.
15. Fast Fourier Transform (FFT), Inverse Fast Fourier Transform(IFFT).

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1-Construct periodic and aperiodic discrete/digital signals using MATLAB
- CO2-Analyze the Frequency response of first and second order systems.
- CO3-Evaluate the basic operations of Signal processing such as convolution and correlation.
- CO4-Determine transfer function and predict frequency response of discrete-time systems by applying various techniques like Z-transform, DFT and FFT using MATLAB
- CO5-Employ signal processing strategies in modulation and demodulation technique
- CO6-Design digital filters such as FIR and IIR Filter and observe the magnitude and phase response

SECA2502	ANALOG INTEGRATED CIRCUITS LAB (For ECE)	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To enable the students to design and testing of analog integrated circuits.
- To expose the students to a variety of practical circuits using various analog ICs.

SUGGESTED LIST OF EXPERIMENTS

- 1 Study of IC 741.
- 2 Measurement of Op amp parameters.
- 3 Inverting, Non Inverting amplifier, Integrator and Differentiator.
- 4 Precision Rectifiers (HW & FW).
- 5 Filters (LPF & HPF).
- 6 A/D & D/Converters.
- 7 RC Phase Shift Oscillator.
- 8 Astable Multivibrator Using IC 741.
- 9 Schmitt Trigger.
- 10 PLL as voltage multiplier.
- 11 Astable Multivibrator using IC 555.
- 12 Comparators.
- 13 Wein's Bridge Oscillator.
- 14 Instrumentation Amplifier.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1-Apply mathematical concepts for understanding the behavior of Operational amplifier
- CO2-Analyze the functioning of various analog circuits
- CO3-Design filter circuits using Op Amp for Real World applications
- CO4-Implement oscillator circuits using IC741
- CO5-Evaluate the performance of various waveform generator circuits.
- CO6-Design analog circuits for various applications

SECA1601	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the architecture of Microprocessor & Microcontroller.
- To familiarise the students in writing assembly programming and interfacing with peripherals.
- To provide foundation and confidence to the students to solve real world problem using Microprocessor and Microcontroller.

UNIT 1 INTRODUCTION TO MICROPROCESSORS**9 Hrs.**

Introduction, 8085 Architecture, Pin Diagram and signals, Timing Diagram, Interrupts and its types, Introduction to 8086 microprocessors and its operation.

UNIT 2 PROGRAMMING 8085 MICROPROCESSOR**9 Hrs.**

8085 assembly language programming- addressing modes, Instruction formats, Instruction Classification- data transfer, arithmetic operations, logical operations, branching operations, I/O and machine control - Stack and subroutines, Example Programs.

UNIT 3 PERIPHERALS AND INTERFACING**9 Hrs.**

Introduction, Serial communication USART (8251), Programmable Peripheral Interface (8255), Programmable Interrupt Controller (8259), Programmable interval timer (8254), DMA controller (8257), Analog to Digital Converter (ADC), and Digital to Analog Converter (DAC).

UNIT 4 8051 MICROCONTROLLER**9 Hrs.**

Introduction to microcontrollers, Difference between microprocessor and microcontroller, Architectural of 8051, Memory architecture, Timers, Interrupts, Addressing Modes and Instruction set of 8051, Programming examples.

UNIT 5 APPLICATIONS BASED ON 8085 AND 8051**9 Hrs.**

Interfacing LED, 7 segment LED Display, Stepper motor control system, Temperature control system, Motor speed control system, Timer application program, Interfacing LCD.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Analyze the internal architecture and operations of microprocessor related to industrial and performance-oriented logics and techniques
- CO2-Analyze various addressing modes and instruction set of microprocessor to structure the programming skills
- CO3-Examine the various processors and to select appropriate processor and controller, based on the performance requirements and implementation
- CO4-Develop assembly language programs through simulation and hardware implementation by assembling and disassembling the machine codes of microcontroller
- CO5-Implement electronic circuitry to the Microprocessor I/O ports in order to interface the processor and controller for various applications
- CO6-Evaluate various assembly language programs based on computation complexity to address Real-World Problems

TEXT / REFERENCE BOOKS

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming and applications with 8085", 6/e, Penram International Publishing Pvt Ltd, 2013.
2. Kenneth J Ayala, "The 8051 Microcontroller", 3rd Edition, Thomson, 2007.
3. Muhammad Ali Mazidi, "The 8051 Microcontroller and Embedded Systems", 2nd Edition, Pearson Education, 2008.
4. Ray A.K, Bhurchandi, K.M, English-"Advanced Microprocessors and Peripherals" by Tata McGraw Hill Education Private Limited-Paperback_Edition- 2nd Edition, 2006.
5. <https://www.mikroe.com/ebooks/architecture-and-programming-of-8051-mcus/introduction>.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 10 Questions of 2 marks each - No choice**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks

B.E. / B.Tech. - Regular

Exam Duration: 3 Hrs.**20 Marks****80 Marks**

REGUALTIONS 2019

SECA1605	PROGRAMMING IN HDL	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To focus on the basic concept of VHDL and Verilog HDL
- To introduce the style of modeling in VHDL and Verilog HDL
- To focus advanced features of Verilog HDL
- To outline the formal procedures for testing and verification of HDL
- To introduce the design of switch level modeling and high level architecture

UNIT 1 CONCEPTS IN VHDL**9 Hrs.**

Introduction to VHDL - Language elements of VHDL -Concurrent and Sequential assignments -Data flow modeling - Concurrent Signal Assignment statements - Structural modeling - Component declaration - Component Instantiation - Behavioral modeling - Process statement - Examples for VHDL modeling.

UNIT 2 INTRODUCTION TO VERILOG HDL**9 Hrs.**

Basic concepts - Levels for design description - Module - Delays - Language elements - Compiler directives - value set - data types - Parameters - Expressions - Operands - operators in verilog HDL.

UNIT 3 STYLES OF MODELING**9 Hrs.**

Gate level modeling -Primitive Gates- Multiple input and multiple output gates - User Defined Primitives - Combination UDP - Sequential UDP- Data flow modeling - Behavioral modeling - procedural constructs - procedural assignments - conditional and loop statements - Structural Modeling - Examples for modeling.

UNIT 4 FEATURES IN VERILOG HDL**9 Hrs.**

Tasks- Functions -systems tasks and functions - Verification - Modeling a test bench - timing and delays - Switch level modeling - state machine modeling - Moore FSM - Melay FSM - Design of RAM, ROM.

UNIT 5 REALIZING APPLICATIONS IN FPGA**9 Hrs.**

FPGA Design Flow - Architecture of Xilinx Artix7 FPGA - Configurable Logic Blocks (CLB)- Slice Description- LUT - Storage element - Programmable Interconnect - Internal Hard macros - Realizing applications in FPGA - combinational functions - N-bit functions, Encoder, Decoders - Sequential functions - N-bit register, shift registers, up/down counters- N-bit processor. Case Study: study of protocols I2C, SPI and UART.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Infer the needs of VHDL and Verilog HDL design flow.
- CO2 - Interpret the Verilog language elements and its relevance to digital design
- CO3 - Articulate different Modelling in HDL for Simulation, Synthesis and Test Bench Creation.
- CO4 - Categorize the characteristics of Combinational and Sequential logic design using HDL.
- CO5 - Evaluate and validate the digital logic circuits by State Machines.
- CO6 - Design and verify the digital logic circuits in FPGA's

TEXT / REFERENCE BOOKS

1. J.Bhaskar, "A VHDL Primer", Prentice Hall of India Limited. 3rd edition 2004
2. Stephen Brown, "Fundamental of Digital logic with Verilog Design", 3rd edition, Tata McGraw Hill, 2008
3. J.Bhaskar, "A Verilog HDL Primer", Prentice Hall of India Limited. 3rd edition 2004
4. Samir Palnitkar "Verilog HDL: A Guide to Digital Design and Synthesis", Star Galaxy Publishing; 3rd edition, 2005
5. Michael D Ciletti - Advanced Digital Design with VERILOG HDL, 2nd Edition, PHI, 2009.
6. Z Navabi - Verilog Digital System Design, 2nd Edition, McGraw Hill, 2005.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 10 Questions of 2 marks each - No choice**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**Exam Duration: 3 Hrs.****20 Marks****80 Marks**

SECA1606	EMBEDDED SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To study the basics of Embedded System.
- To explain the various development tools in Embedded System.
- To acquire knowledge in Embedded Networking.
- To get a knowledge in Embedded programming.
- To acquire knowledge in embedded system testing and its application.

UNIT 1 INTRODUCTION TO EMBEDDED SYSTEM**9 Hrs.**

Embedded system- characteristics of embedded system- categories of embedded system- requirements of embedded systems- challenges and design issues of embedded system- trends in embedded system- system integration- hardware and software partition- applications of embedded system - control system and industrial automation-biomedical-data communication system-network information appliances- IVR systems- GPS systems.

UNIT 2 EMBEDDED SOFTWARE DEVELOPMENT AND TOOLS**9 Hrs.**

Software architectures, Round - Robin, Round-Robin with Interrupts, Function Queue Scheduling architecture, Introduction to assembler - Compiler -Cross compilers, Linker/ Locators, Simulators- Embedded Firmware Design Approaches and Development Languages.

UNIT 3 EMBEDDED NETWORKING**9 Hrs.**

Embedded Networking: Introduction, I/O Device Ports - Serial Bus communication protocols- RS232 standard- RS485 - CAN Bus- Serial Peripheral Interface (SPI) - Inter-Integrated Circuits (I2C) - PC Parallel port communication Protocols -Bluetooth- network using ISA, PCI-. Interrupt service mechanism.

UNIT 4 EMBEDDED PROGRAMMING**9 Hrs.**

Programming in assembly language (ALP) vs High Level Language - C Program elements:- Macros and functions, Use of Data Types, Structure, Pointers, Function Calls - Concepts of Embedded Programming in C++-Objected Oriented Programming, Embedded Programming in C++,'C' Program compilers - Cross compiler- Program level performance analysis-Software performance optimization, Program validation and testing.

UNIT 5 ARDUINO**9 Hrs.**

Introduction to ARDUINO, Architecture, overview of its I/O Ports, Serial Ports, PWM, ADC, Interfacing with different type of Sensors and Communication modules, Hardware timers, watchdogs and interrupt handling in Arduino. Controlling embedded system based devices using Arduino.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Apply knowledge to strengthen the basics of principles of Embedded system and its application
- CO2-Demonstrate various software development tools used to design embedded systems
- CO3-Examine the performance of various communication protocols for embedded systems
- CO4-Analyze the various programming strategies in embedded system
- CO5-Implement embedded system based devices using arduino
- CO6-Develop embedded system for real time applications

TEXT / REFERENCE BOOKS

1. KVKK Prasad, "Embedded / Real Time Systems", Dreamtech Press, 2005.
2. David Simon, "An Embedded Software Primer", Pearson Education Asia, First Indian Reprint 2000.
3. Raj Kamal, "Embedded system-Architecture, Programming, Design", Tata McGraw Hill, 2011.
4. Arnold Berger, "Embedded system design", CMP books, 1st Edition, 2005.
5. Wayne Wolf, "Computers as components", Morgan Kaufmann publishers, 2nd Edition, 2008.
6. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006.
7. Steve Heath, "Embedded Systems Design", 2nd Edition, Elsevier India Pvt.Ltd.,2007.
8. Narayan and Gong, "Specification and design of Embedded System", Pearson Education, 2nd Edition, 1999.
9. Arduino-Based Embedded Systems: By Rajesh Singh, Anita Gehlot, Bhupendra Singh, and Sushabhan Choudhury.
10. Arduino Made Simple by Ashwin Pajankar.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks.****PART B:** 2 Questions from each unit of internal choice; each carrying 16marks**80 Marks**

SECA1604	COMPUTER NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To acquire the knowledge about the basics of computer networking.
- To understand the various IEEE networking standards.
- To familiarize with error detection and correction techniques for data communication.
- To know about the design issues of various layers in ISO-OSI and TCP/IP model.

UNIT 1 DATA COMMUNICATION BASICS**9 Hrs.**

Digital data - digital signals - Bit rate - Bit length - Data rate limits - noise less channels - Noisy channel - Shannon capacity - Performance - Bandwidth - throughput - latency - Bandwidth delay product - jitters. Circuit switched networks - Datagram networks - virtual circuit networks - connection oriented and connection less services - Network Hardware, Network Software, OSI reference model - TCP/IP reference model - comparison of both models.

UNIT 2 NETWORKING**9 Hrs.**

Network Topologies - mesh, star, bus, and ring - hybrid topology - Network Standardization - De facto and De jure standards of networks - MAC Layer- Aloha, CSMA, CSMA/CD, CSMA/CA protocols, Different IEEE802 working groups - internet-Architecture of the internet - Third generation mobile networks - UMTS Architecture - Wired Ethernet - Wireless LANs IEEE 802.11 - RFID - Different types - sensor networks - Multi hop topology of sensor network.

UNIT 3 PHYSICAL LAYER AND DATALINK LAYER**9 Hrs.**

The Physical layer - Media - Twisted pair - coaxial cable - infrared - millimetre wave - PSTN - The local loop modem - ADSL - Switching - Internet over cable - cable modems. Data Link Layer and Logical Link Control (LLC) sub-layer: Framing; Error control including Bit-parity, CRC and Hamming Codes; **Reliable transmission and Automatic Repeat Request (ARQ) protocols including Stop-and-Wait, Go-back-N, and Selective Repeat. Performance analysis of ARQ protocols. Example protocols such as HDLC and PPP.**

UNIT 4 MAC SUB LAYER AND NETWORK LAYER**9 Hrs.**

MAC sub layer for Standard Ethernet, Fast Ethernet, Wireless LAN and broadband wireless. Design issues of network layer - **Routing algorithm - shortest path routing - Distance vector routing - Broadcast routing -Inter domain routing, Congestion control algorithm - Congestion control in virtual circuit and datagram switches - The network layer in the internet - The IP protocol-IP Addresses - IPv6, ARP,DHCP,ICMP, Classless Addressing, Network Address Translation.**

UNIT 5 TRANSPORT LAYER AND APPLICATION LAYER**9 Hrs.**

The transport layer - service provided to the upper layer - Elements of transport protocols - Addressing - connection establishment - connection release - UDP-TCP. Application Layer-Introduction ,providing services, Applications layer paradigms, Client server model, Standard client-server application, E mail - The user agent - Message transfer agent-SMTP - Message access agent: POP and IMAP - File Transfer Protocol - HTTP - SNMP - VOIP.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Analyze the basic concepts and the parameters used in computer networks
- CO2-Evaluate the behavior of various topologies in computer Networks adhering to IEEE standards
- CO3-Analyze the behavior of physical layer and data link layer in ISO OSI reference model
- CO4-Evaluate different routing and congestion control algorithms
- CO5-Implement reliable and unreliable transfer protocols for Real World Problems
- CO6-Develop addressing, error detection and address translation mechanisms for TCP/IP.

TEXT / REFERENCE BOOKS

1. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", 5th Edition, Prentice Hall, 2011.
2. Michael A.Gallo, William Hancock.M, Brooks/Cole "Computer Communications and Networking Technologies", 2001.
3. Richard Lai and Jirachief pattana, "Communication Protocol Specification and Verification", Kluwer Publishers, Boston,1998.
4. Pallapa Venkataram and Sunilkumar S.Manvi, "Communication protocol Engineering", PHI Learning, 2014.
5. Behrouz A. Foruzan, "Data Communication and Networking", 5th Edition, Science Engineering and Math Publications, 2012.
6. W. Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, 2016.
7. L.L.Peterson and B.S.Davie, "Computer Networks", 5th Edition, ELSEVIER, 2011.
8. James F.Kurose, K.W.Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 6th Edition, Pearson Education, 2012.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 10 Questions of 2 marks each - No choice**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks

B.E. / B.Tech. - Regular

Exam Duration: 3 Hrs.**20 Marks****80 Marks**

REGUALTIONS 2019

SECA2601	MICROPROCESSOR AND MICROCONTROLLER LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To understand the operation of Microprocessor & Microcontroller.
- To develop algorithms and write assembly language programs.
- To provide knowledge to solve real time issues using Microprocessor and Microcontroller.

MICROPROCESSOR- 8085

1. Programs using Arithmetic operations.
2. Programs for Code conversions.
3. Largest, smallest and Sorting of an array.

MICROCONTROLLER- 8051

1. Data Transfer Programs.
2. Programs Using Logical Instructions.
3. Programs using Bit manipulation Instructions.
4. Reading and Writing on Parallel port.
5. Stepper Motor controller.
6. Timer Operations.
7. Serial communication Implementation.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1-Develop assembly language programs to perform array operations using 8085 Microprocessor
- CO2-Develop assembly language programs to perform data transfer using 8051 microcontroller
- CO3-Develop assembly language programs to perform Logical and Bit manipulation operations using 8051 microcontroller
- CO4-Develop assembly language programs to interface 7 segment LED, CRO, Traffic light controller and Timer using 8051 microcontroller
- CO5-Develop assembly language programs to interface and control stepper motor using 8051 microcontroller
- CO6-Develop assembly language programs to solve Real World Problems using 8051 microcontroller

SECA2602	VLSI DESIGN LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

- To Give a Introduction on Digital logic systems.
- To explain how combinational circuits are being used.
- To explain how Sequential circuits are being used.
- To explain the importance of memories.

SUGGESTED LIST OF EXPERIMENTS**HDL Design, Simulation, Synthesis and FPGA Implementation of**

- 1 Logic gates.
- 2 Adders and Subtractors.
- 3 4-bit multiplier.
- 4 ALU.
- 5 Flip Flops.
- 6 Shift registers.
- 7 Synchronous and Asynchronous Counters.
- 8 Moore and Mealy FSM.
- 9 RAM and ROM memories.
- 10 MAC unit.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1-Develop various logic gates using different modeling styles
- CO2-Develop digital system design in combinational and sequential circuits using various modeling styles
- CO3-Develop digital system design in memory elements using various modeling styles
- CO4-Analyze the Synthesis report acquired for digital system design
- CO5-Develop RTL schematic and analyze the parameters
- CO6-Develop a FPGA System for Real World Problems

SECA3001	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- Understand OSI security architecture and classical encryption techniques.
- Acquire fundamental knowledge on the concepts of finite fields and number theory.
- Understand various block cipher and stream cipher models.
- Describe the principles of public key cryptosystems, hash functions and digital signature.
- To provide basic concept of network and security system.

UNIT 1 FUNDAMENTALS**9 Hrs.**

The OSI security architecture-Network security model-Principles of Security - Confidentiality, Authentication, Integrity, Nonrepudiation, Access Control, Availability: Types of Attacks - Active and Passive: Classical Encryption Techniques: Substitution Cipher - Caesar Cipher, Play Fair Cipher, Hill cipher, One Time Pad: Transposition Cipher - Rail Fence and Simple Columnar Techniques.

UNIT 2 SYMMETRIC KEY CRYPTOGRAPHY**9 Hrs.**

Symmetric Key Cryptosystems: Comparison of Stream Ciphers and **Block Ciphers**: Feistel Block Cipher: Block Cipher Modes of Operation: Data Encryption Standard - Details of one round in DES: Advanced Encryption Standard.

UNIT 3 PUBLIC KEY CRYPTOGRAPHY**9 Hrs.**

Modular Arithmetic: Euclidean Algorithm: Fermat's and Euler's Theorem; Chinese Remainder Theorem: Principles of Public Key Cryptosystems; Key Management - Distribution of Public Keys, Use of Public Key Encryption to Distribute Secret Keys: RSA Algorithm, Diffie-Hellman Key Exchange; Concepts of Elliptic Curve Cryptography.

UNIT 4 SECURITY FUNCTIONS AND APPLICATIONS**9 Hrs.**

Authentication Requirements: Message Authentication Codes - Requirements for MAC, Basic Uses of MAC: Hash Functions HMAC - Requirements for a Hash function, MD-5 SHA 1 Kerberos: X.509 Authentication Service - Certificate: E-Mail Security - Pretty good Privacy, S/MIME

UNIT 5 NETWORK AND SYSTEM SECURITY**9 Hrs.**

IP Security - IP Security Architecture, Authentication Header, Encapsulating Security Payload, Benefits, Applications; Web Security - Secure Socket Layer, Secure Electronic Transaction -SSL Vs SET, Firewalls -Design Principles, Characteristics, Types of Firewalls: Virus and Antivirus approaches.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Analyze the vulnerabilities in any computing system
- CO2-Estimate the various security threats during data communication in the network.
- CO3-Evaluate security mechanisms using rigorous approaches, including theoretical mechanisms.
- CO4-Apply different IEEE standards in electronic mail security.
- CO5-Develop symmetric key cryptographic techniques for real-time application.
- CO6-Construct the various cryptographic algorithm for emails and web security

TEXT / REFERENCE BOOKS

1. Atul Kahate, "Cryptography and Network Security", 2nd Edition, Tata McGraw-Hill Education Pvt.Ltd., New Delhi, 2011.
2. William Stallings, "Cryptography and Network Security - Principles and Practices", 4th Edition, Prentice-Hall of India Pvt.Ltd., New Delhi, 2006.
3. Behrouz A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2007.
4. Niels Ferguson and Bruce Schneier, "Practical Cryptography", John Wiley and Sons, 2003.
5. Niels Ferguson, Bruce Schneier, Tadayoshi Kohno, "Cryptography Engineering- Design Principles and Practical Applications", Wiley Publishing, Inc, Indiana, 2010.
6. Douglas R Simson "Cryptography - Theory and practice", 1st Edition, CRC Press, 1995.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 10 Questions of 2 marks each - No choice**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**Exam Duration: 3 Hrs.****20 Marks****80 Marks**

SECA3025	TELECOMMUNICATION SYSTEMS AND SERVICES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To introduce the history and the terms of telecommunication systems.
- To study the various signalling techniques used in the telecommunication system.
- To acquire knowledge on traffic in telecommunication systems.
- To introduce the service engineering and the protocols used in telecommunication services.
- To study the various impairments in telecommunication

UNIT 1 FUNDAMENTALS OF TELECOMMUNICATION**9 Hrs.**

Models of telecommunication system. The concept of information volume. Characteristics of analogue audio and video signals. Analogue modulations and their implementations: amplitude and angle modulation, Frequency Division Multiplexing, switching system functions - strowger switching system - cross bar exchange - SPC exchange-End users, nodes and connectivity, telephone numbering and Routing, use of Tandem switches in Local area connectivity, Busy Hour and Grade of Service, Simplex, Half duplex and full duplex, One-way and two-way circuits, Network topologies.

UNIT 2 SIGNALLING IN TELECOMMUNICATION SYSTEMS**9 Hrs.**

Introduction, purpose of signalling, Defining the functional areas-supervisory signalling, address signalling and Call Progress-audio and visual. Signalling techniques - conveying signalling information, evolution of signalling subscriber call progress tones and pushbutton codes, compelled signalling, concepts of Link-by-link and end-to-end signalling, effects of numbering on signalling, associated and disassociated channel signalling, signalling in the subscriber loop, Signalling System R2, SS7 Layers and its Protocol. Synchronous digital hierarchy. Multiplexing PDH signals into SDH STM-1 transport module

UNIT 3 TRAFFIC ENGINEERING**9 Hrs.**

Network traffic load and parameters-Unit of Traffic -Erlang, Centum call second-Grade of Service and blocking probability-Modeling the switching systems, Blocking Models and Loss estimate- Lost calls cleared system, lost calls returned system, lost calls Held system, Delay Systems

UNIT 4 TELECOMMUNICATION SERVICES ENGINEERING**9 Hrs.**

Introduction, definition for service and service engineering. Telecommunication services engineering-Telecommunication services on broad band networks- basics of ATM, connection oriented and connectionless services.

UNIT 5 QUALITY OF SERVICE AND TELECOMMUNICATION IMPAIRMENTS**9 Hrs.**

QoS (voice, data and image)-signal-to-noise ratio, voice transmission, data circuits, video. Basic impairments-amplitude distortion, phase distortion and noise. Level- typical levels, echo and singing. QoS issues in video transmission- problems and solutions. Protocols for QoS support for audio and video applications - RSVP applications, Real-Time Streaming Protocol Applications and Active Streaming, Techniques to improve the Quality of service, Format, Protocol in multicast, IETF Data Tracker.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1 - Analyze the terminologies, and various modulation techniques in telecommunication systems.
- CO2-Analyze the classical signaling with the advanced signaling techniques in telecommunication systems.
- CO3 - Apply the Supporting protocols and to implement various applications.
- CO4 -Implement and regulate the performance of telecommunication networks using various models
- CO5 - Analyze and predict the importance of Service engineering.
- CO6 - Develop the impairments and quality of service in telecommunication systems.

TEXT / REFERENCE BOOKS

1. Roger L. Freeman, "Fundamentals of Telecommunications", 4th Edition, John Wiley & Sons, 2010.
2. Jyrki T. J. Penttinen,"The Telecommunications Handbook: Engineering Guidelines for Fixed, Mobile and Satellite Systems", 1st Edition, Wiley, 2015.
3. Thiagarajan Viswanathan, Manav Bhatnagar,"Telecommunication Switching Systems and Networks", 2nd Edition, PHI learning, 2015.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A : 10 Questions of 2 marks each - No choice****20 Marks.****PART B : 2 Questions from each unit of internal choice; each carrying 16 marks****80 Marks**

SECA3005	BIOMEDICAL SIGNAL PROCESSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand and gain complete knowledge about the fundamentals of biomedical signal processing.
- To develop a theoretical foundation of biomedical signal processing techniques.
- To provide analytic skills to process the ECG and EEG.

UNIT 1 INTRODUCTION**9 Hrs.**

Biomedical Signals - Sources, Properties, Objectives and Difficulties in Biomedical Signal Analysis, Filtering for removal of artifacts - Time domain filters, Frequency domain filters, Optimal filtering.

UNIT 2 MODELLING BIOMEDICAL SYSTEMS**9 Hrs.**

Pont process, Parametric System Modeling, All Pole Modeling, Pole-Zero Modeling, Spectral Modeling, Applications.

UNIT 3 NEUROLOGICAL SIGNAL PROCESSING**9 Hrs.**

The Brain and its potentials; The Electrophysiology origin of brain waves; the EEG Signal and its characteristics; EEG analysis; Statistical parameter mapping of EEG signal; Linear prediction theory; The autoregressive (AR) method; Wiener filtering problem; Principle of an adaptive filter; Steepest - descent algorithm; Windrow-hoff least -mean-square adaptive algorithm.

UNIT 4 CARDIOLOGICAL SIGNAL PROCESSING**9 Hrs.**

Basic electrocardiography; ECG data acquisition; ECG lead system; ECG parameters and their estimation; Use of multi-scale analysis for parameters estimation of ECG waveforms, Adaptive noise canceller; Long term continuous ECG recording; The wavelet approximation - Discrete wavelet transform (DWT); Multi-resolution analysis; Pyramid algorithm.

UNIT 5 HRV AND ARRHYTHMIA ANALYSIS**9 Hrs.**

Heart Rate variability; comparison of short-term and long term HRV analysis; Time domain and spectral domain parameters of short term recording.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Analyze the fundamentals of biomedical signal processing and filters in time domain and frequency domain
- CO2-Apply the principles of modeling for Biomedical systems
- CO3-Apply signal processing techniques on neurological signal
- CO4-Apply various signal processing techniques for cardiological signals
- CO5-Evaluate various signal processing and classification algorithms to obtain HRV and Arrhythmia analysis
- CO6-Model, analyze and predict various pathological conditions using signal processing

TEXT / REFERENCE BOOKS

1. Rangaraj M.Rangayyan, "Biomedical Signal Analysis", Wiley, 2015
2. Kayvan Najarian and Robert Splinter, "Biomedical Signal and Image Processing", 2nd Edition, CRC Press, 2012.
3. Reddy D C. "Modern Biomedical Signal Processing - Principles and Techniques", TMH, New Delhi, 2005.
4. Arnon Cohen "Biomedical Signal Processing" Crc Pr I Llc; 2nd Edition, May, 2002.
5. Tompkins W J "Biomedical Signal Processing", Prentice hall of India, New Delhi, 1999.
6. Bronzino J D "The Biomedical Engineering handbook", CRC and Free press, Florida, 1995.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SECA3007	MEMS AND ITS APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To have adequate knowledge in MEMS and Microsystems.
- To understand the fabrication procedures and have knowledge on MEMS sensors and actuators and their applications.
- To be made aware of the MEMS design procedures and RFMEMS.
- To investigate various applications of MEMS.

UNIT 1 OVERVIEW OF MEMS AND MICROSYSTEMS**9 Hrs.**

Definition - historical development - Fundamentals - Properties, Introduction to Design of MEMS and NEMS, MEMS, Microsystems microelectronics, miniaturization, Working principle of micro system - Micro sensors, Micro actuators, Micro accelerometers and Micro fluidics, MEMS materials: Silicon, silicon compounds, polymers, metals.

UNIT 2 MEMS FABRICATION**9 Hrs.**

Micro-system fabrication processes: Photolithography, Ion Implantation, Diffusion, and Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology.

UNIT 3 MICROSENSORS AND ACTUATORS**9 Hrs.**

Micro-sensing for MEMS: Piezo-resistive Pressure Sensor, Capacitive sensor, Piezoelectric sensing, Resonant sensing, Surface Acoustic Wave sensors Vibratory gyroscope, Electromechanical transducers: Piezoelectric transducers, Electrostrictive transducers, Magnetostrictive transducers, Electrostatic actuators, Electromagnetic transducers, Electrodynamic transducers, Case study-Piezo-resistive pressure sensor, Comb drive actuators.

UNIT 4 MEMS DESIGN AND INTRODUCTION TO OPTICAL RF MEMS**9 Hrs.**

Micro system Design - Design consideration, process design, Mechanical design, Mechanical design using MEMS. Optical MEMS,- System design basics - Gaussian optics, Matrix operations, Resolution. MEMS scanners and retinal scanning display, Digital Micro mirror devices. RF Memes - Design basics, case study - Capacitive RF MEMS switch, Performance issues.

UNIT 5 MEMS PACKAGING AND APPLICATIONS**9 Hrs.**

MEMS packaging: Role of MEMS packaging, Types of MEMS packaging, selection of packaging materials, flip-chip and multichip Unit packaging, RF MEMS packaging issues. Micro-machined transmission line and components, micro-machined RF Filters, Micromachined Phase shifters, and Micro-machined antenna, Gyros and Bio-MEMS. Recent trends in MEMS.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Identify right choice of MEMS materials and processing techniques for given application requirement
- CO2-Design micro devices and micro systems for given specifications.
- CO3- Analyze the characteristics of MEMS devices
- CO4-Design MEMS based sensors and actuators for given requirement
- CO5-Design micro-machined RF components and devices such as Switches, phase shifters, antennas, etc for given specifications
- CO6-Investigate various applications of MEMS devices

TEXT / REFERENCE BOOKS

1. Vijay K. Varadan, K. J. Vinoy and K. A. Jose, "RF MEMS & Their Applications", John Wiley & Sons, 2003.
2. Tai - Rai Hsu, "MEMS and Microsystems Design and Manufacturing", Tata MC Graw Hill, New Delhi, Edition 2002.
3. Gabriel M Rebeiz, "RF MEMS - Theory Design and Technology", John Wiley and Sons, 2003.
4. Nadim Maluf, "An introduction to Micro electro mechanical system design", Artech House, 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SECA3008	WIRELESS SENSOR NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the basic concepts of wireless sensor networks, Mobile Adhoc Networks.
- To study about localization and routing protocols.
- To learn the concepts of data management.
- To acquire the knowledge of operating systems and infrastructure establishment in wireless networks.

UNIT 1 INTRODUCTION TO SENSOR NETWORKS**9 Hrs.**

Introduction to Sensor Networks, unique constraints and challenges in WSN, Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc NETWORKS (MANETs) and Wireless Sensor Networks, Design principles for WSNs.

UNIT 2 LOCALIZATION AND ROUTING**9 Hrs.**

Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, selfconfiguring localization systems, sensor management Network Protocols: Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and Zig Bee, Dissemination protocol for large sensor network. Routing protocols: Issues in designing routing protocols, Classification of routing protocols, Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing.

UNIT 3 DATA MANAGEMENT AND MANIPULATION**9 Hrs.**

Storage and retrieval in network, compression technologies for WSN, Data aggregation technique, Data management in WSN, Storage and indexing in sensor networks, Query processing in sensor, Directed Diffusion, Tiny aggregation, greedy aggregation, security in WSN.

UNIT 4 OPERATING SYSTEMS FOR WIRELESS NETWORKS**9 Hrs.**

Introduction - Operating System Design Issues - Examples of Operating Systems - TinyOS - Mate - MagnetOS - MANTIS - OSPM - EYES OS - SenOS - EMERALDS - PicOS - Introduction to Tiny OS - NesC - Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM.

UNIT 5 INFRASTRUCTURE ESTABLISHMENT**9 Hrs.**

Topology Control, controlling topology in flat networks, Hierarchical networks, Clustering, Time Synchronization, Sensor Tasking and control.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Analyze various challenges in designing of Wireless Sensor Networks and MANETs
- CO2-Categorize the Localization and Routing Techniques in WSN adhering to the IEEE standards
- CO3-Design techniques for the storage, retrieval and manipulation of data in WSN
- CO4-Evaluate the different data aggregation techniques in WSN
- CO5-Design suitable topologies for various Real World Problems
- CO6-Develop a suitable WSN for processing task controlled sensor

TEXT / REFERENCE BOOKS

- HolgerKerl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", JohnWiley and Sons, 2005 (ISBN:978-0-470-09511-9).
- Raghavendra, Cauligi S, Sivalingam, Krishna M., ZantiTaieb, "Wireless Sensor Network", Springer 1st Edition. 2004 (ISBN:978-4020-7883-5).
- Feng Zhao, Leonidas Guibas, "Wireless Sensor Network", Elsevier, 1st Edition. 2004 (ISBN: 13- 978-1-55860-914-3).
- Kazem, Sohrawy, Daniel Minoli, TaiebZanti, "Wireless Sensor Network: Technology, Protocols and Application", John Wiley and Sons 1st Edition., 2007 (ISBN: 978-0-471-74300-2).
- B. Krishnamachari, "Networking Wireless Sensors", Cambridge University Press.
- N. P. Mahalik, "Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications" Springer Verlag.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 10 Questions of 2 marks each - No choice**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**Exam Duration: 3 Hrs.****20 Marks****80 Marks**

SECA3010	RF IC DESIGN	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To acquaint the students with the behaviour of passive and active electronic components at Radio frequencies.
- To familiarize on the principle of operation of various building blocks of RF transceivers.
- To understand the functional design aspects of LNAs, Mixers and VCO and Cadence simulation tools.

UNIT 1 RF BEHAVIOUR OF PASSIVE ELECTRONIC COMPONENTS**9 Hrs.**

Introduction to Radio frequency models of resistors, capacitors and Inductors. Integrated inductors, resistors, Capacitors, tunable inductors and transformers. Design of RF lumped element lowpass and high pass filters -Introduction to Richards Transformations and Kuroda Identities (definition only)-Design of stepped impedance distributed element lowpass and high pass filters.

UNIT 2 BJT AND MOSFET BEHAVIOR AT RF FREQUENCIES**9 Hrs.**

BJT and MOSFET modeling at low frequency and radio frequencies. Radio frequency SPICE models of BJT and MOSFETs. Noise performance and limitations of MOSFETs-Introduction to Cadence Simulation tool.

UNIT 3 INTRODUCTION TO TRANSCEIVER ARCHITECTURES**9 Hrs.**

RF Receiver (front end) Architectures- Basic and Modern Heterodyne Receiver - Direct-Conversion Receiver - Low-IF Receiver - Transmitter Architectures - Direct-Conversion Transmitters and Heterodyne Transmitters.

UNIT 4 RF CMOS AMPLIFIERS**9 Hrs.**

RF Amplifier Parameters-Low noise Amplifier (LNA) topologies- Design aspects of Common gate (CG) and Common Source CMOS LNA- Introduction to CMOS RF Power Amplifier Design.

UNIT 5 RF CMOS MIXERS AND VCOs**9 Hrs.**

Introduction to Frequency Mixer and its parameters-single balanced and double balanced active Mixer- Gilbert Mixer Circuit- Basics of Voltage Controlled Oscillators(VCO)- VCO using MOS varactors- Design of LC VCOs. Introduction to Frequency Mixer and its parameters-single balanced and double balanced active Mixer- Gilbert Mixer Circuit- Basics of Voltage Controlled Oscillators(VCO)- VCO using MOS varactors- Design of LC VCOs.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Analyze the frequency range of technologies used for passive and active RF circuit implementation
- CO2-Analyze the behavior of RF frequency signals in transistor environment
- CO3-Evaluate the operations of Transceiver architecture noise, linearity, etc
- CO4-Analyze the behavior of CMOS low noise amplifiers and RF Power Amplifiers in noisy and noiseless environment
- CO5-Design voltage controlled oscillators for Real World problems
- CO6-Develop RF circuits for specific applications using Cadence simulation tools

TEXT / REFERENCE BOOKS

1. B.Razavi, "RF Microelectronics", 2nd Edition, Prentice-Hall, 2011.
2. Bosco H Leung "VLSI for Wireless Communication", 2nd Edition, Springer, 2011.
3. Behzad Razavi, "Design of Analog CMOS Integrated Circuits" 2nd Edition, McGraw-Hill, 2017.
4. Jia-sheng Hong, "Microstrip filters for RF/Microwave applications", Wiley, 2nd Edition, 2011.
5. Thomas H.Lee, "The Design of CMOS Radio -Frequency Integrated Circuits", 2nd Edition, Cambridge University Press, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SECA3011	ARTIFICIAL INTELLIGENCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the various characteristics of Intelligent agents.
- To learn the different search strategies in AI.
- To learn to represent knowledge in solving AI problems.
- To know about the various applications of AI.

UNIT 1 INTRODUCTION TO ARTIFICIAL INTELLIGENCE**9 Hrs.**

Introduction-Definition - Future of Artificial Intelligence - Characteristics of Intelligent Agents-Typical Intelligent Agents - Problem Solving Approach to Typical AI problems.

UNIT 2 PROBLEM SOLVING METHODS**9 Hrs.**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems - Constraint Propagation - Backtracking Search - Game Playing - Optimal Decisions in Games - Alpha - Beta Pruning - Stochastic Games.

UNIT 3 KNOWLEDGE REPRESENTATION**9 Hrs.**

First Order Predicate Logic - Prolog Programming - Unification - Forward Chaining-Backward Chaining - Resolution - Knowledge Representation - Ontological Engineering-Categories and Objects - Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information.

UNIT 4 SOFTWARE AGENTS**9 Hrs.**

Architecture for Intelligent Agents - Agent communication - Negotiation and Bargaining - Argumentation among Agents - Trust and Reputation in Multi-agent systems.

UNIT 5 APPLICATIONS**9 Hrs.**

AI applications - Language Models - Information Retrieval- Information Extraction - Natural Language Processing - Machine Translation - Speech Recognition.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Applied Mathematical equations for developing learning Techniques in AI
- CO2-Analyze various searching techniques for solving Real World Problems
- CO3-Applied predicate logic, ontology and reasoning for knowledge representation in artificial Intelligence
- CO4-Analyze various techniques involved in intelligent agents for communication in AI systems
- CO5-Develop AI based techniques for Real world Applications
- CO6-Evaluate the performance of AI based systems for NLP, Machine translation and speech recognition

TEXT / REFERENCE BOOKS

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, 3rd Edition, 2009.
2. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc.; 1st Edition, 2008.
3. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.
4. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", 5th Edition, Springer, 2003.
5. Gerhard Weiss, "Multi Agent Systems", 2nd Edition, MIT Press, 2013.
6. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2010.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A :** 10 Questions of 2 marks each - No choice**20 Marks.****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks.**

SECA3017	OPTICAL NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To acquaint the students with basic optical communication components, topologies and types of networks.
- To familiarize on the principle of optical amplification and coupling.
- To make the students knowledgeable of various optical network topologies operations, limitations and its practical applications.
- To understand the choice of networks in optical communication.

UNIT 1 INTRODUCTION TO OPTICAL FIBRE**9 Hrs.**

Ray diagram, different types of optical fibre, step index, graded index. Mode Cut-Off wavelength, Mode-field Diameter, Equivalent Step-Index (ESI) Profile, Dispersion Measurements, Mechanical Strength of Optical Fibre. WDM network evolution, WDM network construction, broadcast and select optical WDM network, wavelength routed optical WDM network, Challenges of optical WDM network, OFDM.

UNIT 2 OPTICAL NETWORKING COMPONENTS / BUILDING BLOCKS**9 Hrs.**

Advantages of optical network, telecom network overview and architecture, WDM optical networks, WDM network evolution, WDM network construction, broadcast and select optical WDM network, wavelength routed optical WDM network, Challenges of optical WDM network. Optical transmitters, semiconductor laser diode, tunable and fixed laser, laser characteristics, photodetectors, tunable and fixed optical filters, channel equalizers, optical amplifiers and its characteristics, semiconductor laser amplifier, Raman amplifier, doped fiber amplifier, various Switching elements, OADM, OXC, CLOS architecture, MEMS, wavelength convertors.

UNIT 3 NETWORK TOPOLOGIES**9 Hrs.**

Robust networks, Line and path protection switching, Types of topology, Point to point topology, bi-directional line-switched ring (BLSR), meshed topology, Passive optical networks, Metro optical networks 28 MPLS and Optical Networks: IS label switching, Forwarding equivalence class (FEC), Types of MPLS nodes, Label distribution and binding, label swapping and traffic forwarding, MPLS support of Virtual Private Networks (VPN), MPLS traffic engineering, Multi-protocol Lambda switching (MPIS).

UNIT 4 SINGLE AND MULTIHOP NETWORKS**9 Hrs.**

Introduction to single and multi-hop networks, Characteristics of single and multi-hop networks, Experimental single hop networks: LAMBDANET, STARNET, SONATA, Rainbow, experimental multi-hop networks: Shuffle net, De Bruijn Graph, Hypercube.

UNIT 5 OPTICAL ACCESS AND METRO NETWORK**9 Hrs.**

Introduction to access network, PON, EPON and WDN EPON: overview, principal of operation, architecture; dynamic wavelength allocation, STARGATE: overview, need, architecture, operation and application, gigabit Ethernet, radio over fiber network. Introduction to metro network, overview of traffic grooming in SONET ring, traffic grooming in WDM ring, Interconnected WDM networks, packet communication using tunable WADM, RINGOSTAR: architecture, proxy stripping, protection and network lifetime.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Analyze the various causes for signal degradation and estimate the different types of losses occurring in transmission of energy
- CO2-Illustrate the necessity of using couplers and connectors in energy transmission
- CO3-Apply the principles of Wavelength Division Multiplexing on advanced devices
- CO4-Analyze the optical communication link using various types of network topologies
- CO5-Evaluate the dynamic wavelength allocation for Access networks
- CO6-Analyze the characteristics of optical access and metro networks

TEXT/REFERENCE BOOKS

1. Olivier Bouchet, HerveSizun, Christian Boisrobert and Frederique De Forne, "Free-Space Optics: Propagation and Communication", John Wiley and Sons, 2010.
2. Rajiv Ramaswami and Kumar Sivarajan, "Optical Networks - Practical Perspective", 3rd Edition, Morgan - Kaufmann Publishers.
3. Larry Peterson and Bruce Davie, "Computer Networks, A Systems Approach", 5th Edition, 2011, Morgan Kaufmann.
4. B. Mukherjee, "Optical WDM Networks," Springer, 2006.
5. R. C. Sivamurthy, G. Mohan, "WDM Optical Networks: Concepts, Design And Algorithms," PHI Learning Pvt Ltd, 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2marks each-No choice**20 Marks****PARTB:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SEIA3004	SOFT COMPUTING TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To learn the key aspects of Neural networks, Fuzzy logic components and building block hypothesis of Genetic algorithm.
- To adopt these techniques in solving problems in the real world.

UNIT 1 INTRODUCTION TO SOFT COMPUTING AND ARTIFICIAL NEURAL NETWORKS**9 Hrs.**

Evolution of Computing - Soft Computing Constituents - From Conventional AI to Computational Intelligence - Machine Learning Basics, Fundamentals of ANN - Biological Neurons and Their Artificial Models - Types of ANN - Properties - Different Learning Rules - Types of Activation Functions - Training of ANN - Hebb learning - Perceptron Model (Both Single and Multi Layer) - Training Algorithm - Problems Solving Using Learning Rules and Algorithms - Linear Separability - Limitation.

UNIT 2 DETERMINISTIC AND STATISTICAL NETWORKS**9 Hrs.**

Back Propagation Training Algorithm - Practical Difficulties - Counter Propagation Network - Structure & Operation - Training of Kohonen and Grossberg Layer - Applications of BPN & CPN - Statistical Method - Training Application - Boltzman Training - Cauchy Training - Hop Field Network and Boltzman Machine - Speed Energy Function - Network Capacity - RBF Network, BAM, Architecture of SOM, ANN based water level controller.

UNIT 3 FUZZY LOGIC**9 Hrs.**

Introduction to Fuzzy Set Theory - Basic Concepts of Fuzzy Sets - Classical Set Vs Fuzzy Set - Properties of Fuzzy Set - Fuzzy Logic Operation on Fuzzy Sets - Fuzzy Logic Control Principles - Fuzzy Relations - Fuzzy Rules - Defuzzification - Fuzzy Inference Systems - Fuzzy Expert Systems - Fuzzy Decision Making.

UNIT 4 FUZZY LOGIC CONTROLLER & ITS APPLICATION**9 Hrs.**

Fuzzy Logic Controller - Fuzzification Interface - Knowledge Base- Decision Making Logic - Defuzzification Interface- Application of Fuzzy Logic to Water Level Controller - Temperature Controller - Control of Blood Pressure during Anaesthesia. Introduction to Neuro - Fuzzy Systems - Fuzzy System Design Procedures - Fuzzy Sets and Logic Background - Fuzzy / ANN Design and Implementation.

UNIT 5 GENETIC ALGORITHMS**9 Hrs.**

Introduction - Robustness of Traditional Optimization and Search Techniques - The goals of optimization - Survival of the Fittest - Fitness Computations - Cross over - Mutation - Reproduction - Rank method - Rank space method.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of this course, student will be able to

- CO1-Analyze both supervised and unsupervised learning techniques in ANN
- CO2-Develop solution to real world problems using BPN, CPN, RBF, SOM and Boltzman machine
- CO3-Apply mathematical equations for developing fuzzy based systems
- CO4-Develop FLC for Real World Problems
- CO5-Analyze various techniques used for optimization in Fuzzy and neural networks
- CO6-Develop GA based solutions for Real World Problems

TEXT / REFERENCE BOOKS

- Laurene Fausett, "Fundamentals of Neural Networks: Architectures, Algorithms and Applications" 2008.
- Timothy J. Ross, "Fuzzy Logic with Engineering Applications", McGraw - Hill International Editions, 2004.
- Jang J.S.R., Sun C.T. and Mizutani E, "Neuro-Fuzzy and soft computing", Pearson Education, 2003.
- Rajasekaran. S, Pai. G.A.V. "Neural Networks, Fuzzy Logic and Genetic Algorithms", Prentice Hall of India, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each-No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks**

SCSA1601	MACHINE LEARNING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To focus on the construction and study of algorithms that can learn from data.
- To emphasize on the logical, knowledge-based approach.
- To introduce students to the basic concepts and techniques of Machine Learning.
- To develop skills of using recent machine learning software for solving practical problems.
- To gain experience of doing independent study and research.

UNIT 1 INTRODUCTION TO MACHINE LEARNING**9 Hrs.**

Machine learning - examples of machine learning applications - Learning associations - Classification -Regression - Unsupervised learning - Supervised Learning - Learning class from examples - PAC learning -Noise, model selection and generalization - Dimension of supervised machine learning algorithm.

UNIT 2 DECISION THEORY**9 Hrs.**

Bayesian Decision Theory- Introduction- Classification - Discriminant function-Bayesian networks-Association rule - Parametric Methods - Introduction - Estimation -Multivariate methods-Data Parameter estimation-Dimensionality Reduction- PCA-Linear discriminant analysis.

UNIT 3 CLUSTERING & REGRESSION**9 Hrs.**

Clustering - Mixture densities - k-means clustering - Supervised Learning after clustering - Hierarchical clustering - Nonparametric Methods - Density estimation - Generalization of multivariate data - Smoothing models -Decision Trees - Univariate trees - Multivariate trees - Learning rules from data - Linear Discrimination-Gradient Descent

UNIT 4 MULTILAYER PERCEPTRONS**9 Hrs.**

Structure of brain - Neural networks as a parallel processing - Perceptron - Multilayer perceptron - Back propagation - Training procedures - Tuning the network size - Learning time.

UNIT 5 LOCAL MODELS**9 Hrs.**

Competitive learning - Adaptive resonance theory - Self organizing map -Radial Basis functions - Bagging- Boosting- Reinforcement Learning.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Comprehend machine learning solutions to classification, regression and clustering problems
- CO2-Understand the strengths and weaknesses of many popular machine learning approaches
- CO3-Interpret the results of the algorithms.
- CO4-Select suitable model parameters for different machine learning techniques
- CO5-Design algorithms for real world problems using machine learning algorithm
- CO6-Gain experience of doing independent study and research

TEXT / REFERENCE BOOKS

1. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, 2004.
2. Tom Mitchell, "Machine Learning", McGraw Hill, 1997.
3. Shai Shalev-Shwartz and Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 12 marks**80 Marks**

SCSA1102	PYTHON PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand why Python is a useful scripting language for developers.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to build and package Python modules for reusability.
- To learn how to read and write files in Python.
- To learn how to use exception handling in Python applications for error handling.
- To learn how to design and program Python applications.

UNIT 1 INTRODUCTION**9 Hrs.**

History of Python- Introduction to the IDLE interpreter (shell) -Expressions - Data Types - Built-in function - Conditional statements - Iterative statements- Input/output -Compound Data Types - Nested compound statements - Introduction to Object Oriented Concepts.

UNIT 2 FILES AND EXCEPTIONS HANDLING , MODULES, PACKAGES**9 Hrs.**

File Operations -Iterators - Exception handling - Regular Expressions- Creating Modules-Import Statement-Introduction to PIP-Installing Packages via PIP-Using Python Packages.

UNIT 3 GUI PROGRAMMING**9 Hrs.**

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts - Colours - Canvas - Widgets (frame, label, button, check box, entry, listbox, message, radiobutton, text, spinbox).

UNIT 4 DATABASE AND NETWORK**9 Hrs.**

Database (using NoSQL): Connector Module -Cursor - Statements - Exceptions in database.
Network connectivity: Socket module - Client - Server - Email - URL Access.

UNIT 5 CASE STUDY**9 Hrs.**

Web Programming using Python Image Processing - Facebook Analysis - Twitter Analysis.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to

- CO1-Comprehend concepts of lists, tuples dictionaries in python.
- CO2-Develop code for file operations and exception handling.
- CO3-Design GUI based applications.
- CO4-DemonstrateWeb programming concepts using Python
- CO5-Construct Web based applications by integrating with NoSQL Database.
- CO6-Implement machine learning algorithms using Python libraries.

TEXT BOOKS / REFERENCES

1. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 2013.
2. Paul Gries, Jennifer Campbell, Jason Montojo, "Practical Programming: An Introduction to Computer Science Using Python 3", Pragmatic Bookshelf, 2nd Edition, 2014.
3. Magnus Lie Hetland, "Beginning Python: From Novice to Professional", Apress.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 12 marks**80 Marks**

SECA3021	DIGITAL SYSTEM DESIGN AND VERIFICATION USING SYSTEM VERILOG	L	T	P	Credits	Total Marks
		2	0	2	3	100

Course Objectives

- To explore the fundamental concepts of verilog
- To understand system Verilog data types and capabilities
- To enumerate system Verilog RTL and abstraction
- To analyze dynamic types and arrays for behavioral modeling
- To evaluate System Verilog Assertions for design and verification

UNIT I DIGITAL DESIGN USING VERILOG HDL 9 Hrs

Hardware modeling with the Verilog HDL: Encapsulation, modeling primitives, Types of Modelling. Logic system, Data types and operators. Behavioral descriptions in verilog HDL. Styles for Synthesis of combinational logic and sequential logic. HDL based Synthesis - Technology independent design

UNIT II INTRODUCTION TO SYSTEM VERILOG 9 Hrs

SystemVerilog standards, Key SystemVerilog enhancements for hardware design. Advantages of System Verilog over Verilog, Data Types: Verilog data types, System Verilog data types, 2 - State Data types, Bit, byte, shortint, int, longint. 4 - State data types. Logic, Enumerated data types, User Defined data types, Struct data types, Strings, Packages, Type Conversion: Dynamic casting, Static Casting, Memories: Arrays, Dynamic Arrays, Multidimensional Arrays, Packed Arrays, Associative Arrays, Queues, Array Methods, Tasks and Functions: Verilog Tasks and Functions

UNIT III CONNECTING THE TEST BENCH AND DESIGN 9 Hrs

Verilog interface signals - Limitations of Verilog interface signals, SystemVerilog interfaces, SystemVerilog port connections, Interface instantiation, Interfaces Arguments, Interface Modports, Interface References, Tasks and functions in interface, Verilog Event Scheduler, SystemVerilog Event Scheduler, Clocking Block, Input and Output Skews, Typical Testbench Environment, Verification plan

UNIT IV CONSTRAINED RANDOMIZATION 9 Hrs

Random Variables - rand and randc, Randomize() Method - Pre/Post Randomize() methods, Constraints in the class, Rand_mode and constraint_mode, Constraint and Inheritance, Constraint Overriding, Set Membership, Distribution Constraints, Conditional Constraints - .implication (->), if/else, Inline Constraints

UNIT V FUNCTIONAL COVERAGE AND ASSERTION BASED VERIFICATION 9 Hrs

Coverage Definition, Code Coverage, Functional Coverage: Cover Group, Creating Cover Group Instances, Coverpoints, Bins - implicit bins, . Explicit bins, Bin creation, Vector and Scalar bins, Cross products, Intersect, Select Expressions, Conditional Expression (iff), Illegal bins, Ignore bins, Coverage Analysis, Covergroup Built-in Methods - .Sample(), . get_coverage(), .get_instance_coverage(), .set_instance_name(string), .start(), . stop()

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Understand the digital system designs skills using VERILOG HDL based on IEEE-1364 standards and managed by Open Verilog International (OVI)

CO2: Model digital systems in Verilog HDL at different levels of abstraction

CO3: Know the simulation techniques and test bench creation.

CO4: Demonstrate the skill on writing test-benches for design of digital systems and connecting them with the design.

CO5 Analyze the complete systems through robust verification methods such as assertion based verification.

CO6 Design the digital systems such as FIFOs, memories, ATM interfaces, etc. using the learnt methods and demonstrate the skills.

TEXT/REFERENCE BOOKS

- Advanced Digital Design With the Verilog HDL, Michael D. Ciletti, 2nd Edition, PHI, ISBN: 978-0- 07-338054-4 2015.
- Digital Systems Design Using Verilog, Charles Roth, Lizy K. John, Byeong KilLee, Cengage Learning, ISBN-10: 1285051076, 2015.
- Fundamentals of Digital Logic with Verilog Design, Stephen Brown and Zvonko Vranesic, 6th Edition, McGraw Hill publication, ISBN: 978-0-07-338054-4, 2014.
- System Verilog for Design - A Guide to Using System Verilog for Hardware Design and Modeling, Stuart Sutherland, Simon David mann and Peter Flake, 2E, Springer Science, ISBN-13: 978-0387-3339-91, 2006.
- System Verilog for Verification-A Guide to Learning the Testbench Language Features, C Spear, Springer Science, IEEE press, ISBN-13: 978-0387-2703-64, 2006.
- SystemVerilog golden reference guide-A concise guide to System Verilog Doulos ,IEEE Standard-1800- 2009, Version 5.0, ISBN: 0-9547345-9-9, 2012.
- Step-by-Step Functional Verification with System Verilog and OVM, SasanIman, Hansen Brown Publishing Company, ISBN-13: 978-0-9816-5621-2, 2008.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 10 Questions of 2 marks each - No choice

B.E. / B.Tech. - Regular

Exam Duration: 3 Hrs.

20 Marks

REGUALTIONS 2019

PART B: 2 Questions from each unit of internal choice; each carrying 12 marks**80 Marks**

SECA3022	Graphical Programming for Engineers	L	T	P	Credits	Total Marks
		2	0	2	3	100

Course Objectives

- Students will understand each topic by doing exercise
- Two sessions will be handled by industry people towards project
- This is a learning by doing course
- The learner can use this tool to understand any subjects by implementing or simulating the concept using LabVIEW
- Students can able to do their project in short span of time

UNIT I LABVIEW FOUNDATIONS**9 Hrs**

LabVIEW Operating Environment-Front Panels, Controls and Indicators, Block Diagrams, LabVIEW Projects, Creating Vis, Basic Controls and Indicators, Debugging Techniques, Creating SubVIs

UNIT II CONTROLLING PROGRAM EXECUTION WITH STRUCTURES**9 Hrs**

For and While Loops, Shift Registers, Case Structure, Sequence Structure, Timed Structures, Formula and Expression Nodes, Combining While Loops with Case Structure.

UNIT III ARRAYS AND CLUSTERS & CHARTS AND GRAPHS**9 Hrs**

Array Controls and Indicators, Auto-Indexing, Two Dimensional Arrays, Compound Arithmetic, Cluster Controls and Indicators, Interchangeable Arrays and Clusters, Error Clusters and Error Handling Functions., Waveform Charts, Waveform Graphs, X-Y Graphs, Time Stamps

.UNIT IV SIGNAL CONDITIONING & DATA ACQUISITION SYSTEMS**9 Hrs**

Introduction- Basic Signal Conditioning Requirements of Common Transducers- Thermocouple- RTDs- Strain Gauges- Current Signals- General Signal Conditioning Functions- Amplification- Filtering and Averaging- Isolation- Multiplexing- Digital Signal Conditioning.

UNIT V APPLICATION USING GRAPHICAL PROGRAMMING**9 Hrs**

Logging Temperature data to a text file, Signal noise removal, water tank control, Function Generator, Equalizer design, Signal spectrum measurement, PAM, FM, ASK, FSK modulation

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1- Develop and edit functional block diagrams and front panels.
- CO2- Develop codes to load, save, and debug VIs.
- CO3- Analyze program execution through structures such as 'For-While' loops and 'Case Structures
- CO4- Analyze composite data in the form of Arrays and Clusters
- CO5- Implement techniques to acquire and process signals and can able to realize engineering concept using LabVIEW
- CO6- Develop solutions to the given problem using LabVIEW

TEXT/REFERENCE BOOKS

1. Jeffrey Travis, Jim Kring, Labview for Everyone: Graphical Programming Made Easy and Fun, 3rd Edition, 2009.
2. www.ni.com
3. <http://www.learnni.com/getting-started/Home/Index/91>
4. <https://www.halvorsen.blog/documents/tutorials/tutorials.php>

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A: 10 Questions of 2 marks each - No choice****20 Marks****PART B: 2 Questions from each unit of internal choice; each carrying 12 marks****80 Marks**

SECA3023	AUGMENTED REALITY AND VIRTUAL REALITY	L	T	P	Credits	Total Marks
		2	0	2	3	100

Course Objectives

- To explore the basic of AR/VR technology and devices
- To understand the various elements and components used in AR/VR Hardware and Software
- To explore the industrial application of AR/VR technology
- To analyze the difference between AR and VR
- To enable working on real life projects using AR/VR technology

UNIT I AUGMENTED REALITY 9 Hrs

Introduction to Augmented Reality, Augmented and Mixed Reality, Taxonomy, technology and features of augmented reality, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems

UNIT II DEVELOPMENT OF AR MODELS 9 Hrs

Unity, Basics of Unity, Understanding different panels in Unity, Moving, rotating & scaling Game objects in Unity, Game Panel in Unity, Physics in Unity, Increasing the light intensity, Adding colors to Game object, Adding textures to Game object, Parent and child Game objects in Unity, Local/Global and Pivot/Center tools in Unity, Prefabs in Unity, Scripts, Rotating the spheres, Revolving the spheres

UNIT III AUGMENTED REALITY ONE SECTION(ARONE) INTRODUCTION 9 Hrs

Augmented Reality One (AROne) Section Introduction, Importing Vuforia package inside Unity, Importing Vuforia package via Vuforia Core Samples, Web Camera output and creating the ARONE License Key, Capturing an Image, Creating a Vuforia Database and uploading Image Targets, Projecting Barbarian 3D Model on Image Target, Testing the output on an Android smartphone, Testing the output on iPhone or iPad.

UNIT IV VIRTUAL REALITY 9 Hrs

Introduction of Virtual Reality, Fundamental Concept and Components of Virtual Reality, Difference between AR and VR, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark, Primary Features and Present Development on Virtual Reality, Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection

UNIT V AR / VR APPLICATIONS 9 Hrs

Engineering, Entertainment - Movies, Game development, Science, Medical applications, military applications, robotics application, Case study - CRO based experiment, Building Electronic circuit using AR/VR.

Course Outcomes

On completion of the course, the student will be able to

CO1-Apply mathematical concepts for understanding Augmented reality and Virtual Reality

CO2-Analyze the development of AR models

CO3-Analyze various Vuforia package inside Unity

CO4-Develop a Virtual reality Model

CO5-Implement AR/VR in game development

CO6-Build any Electronic circuit using AR/VR

TEXT / REFERENCE BOOKS

1. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
2. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009
3. Grigore C. Burdea, Philippe Coiffet, Virtual Reality Technology, Wiley 2016
4. Jason Jerald. 2015. The VR Book: Human-Centred Design for Virtual Reality. Association for Computing Machinery and Morgan & Claypool, New York, NY, USA, . 2015.
5. Augmented Reality: Principles and Practice (Usability) by Dieter Schmalstieg & Tobias Hollerer, Pearson Education (US), Addison-Wesley Educational Publishers Inc, New Jersey, United States, 2016.
6. Learning Virtual Reality: Developing Immersive Experiences and Applications for Desktop, Web, and Mobile, Tony Parisi, O'Reilly Media; 1 edition, 2015.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 10 Questions of 2 marks each - No choice

20 Marks

PART B: 2 Questions from each unit of internal choice; each carrying 12 marks

80 Marks

SECA3023	ADVANCED ELECTRONIC TESTING	L	T	P	Credits	Total Marks
		2	0	2	3	100

Course Objectives

- To impart knowledge on various types of printed circuit boards.
- To understand component level and board level automated testing methodologies.
- To impart knowledge on automated test equipment system architecture.
- To understand the principle of fault simulation and test fixture design for automated testing
- To disseminate the importance of design for testability.
- Study about the applications of computer vision in automated PCB testing

UNIT I PCB TECHNOLOGY AND TESTING METHOD**9 Hrs**

Printed Circuit Boards(PCB) - Construction - Types of PCB - Multilayer - Surface Mount technology - PCB Manufacturing process - Fault types and causes in circuits during manufacturing- PCB Inspection methods - Bare Board Testing - Optical and X-Ray Inspection.

UNIT II ELECTRICAL TESTING OF ASSEMBLED PCB**9 Hrs**

Symptom Recognition - Component failure Analysis - Manual trouble shooting technique - Electrical tests - Text fixtures - Bed of nails fixtures - Cross talk test - Mock up test - In circuit test - Burn-in-test - Fault diagnostic methods- Electromagnetic compatibility testing of electronic components, subassemblies.

UNIT III AUTOMATED TROUBLE SHOOTING TECHNIQUES**9 Hrs**

ATE Techniques - CPU Emulator technique - ROM and ROM Emulators - In circuit Comparator - In Circuit Functional test - Trouble shooting digital gates - Testing Linear Integrated Circuits - Guarding Technique - VI trace Technique - Bus Cycle Signature System - Board functional test methods - Boundary scan test basics.in RTOS

UNIT IV ATE SYSTEM ARCHITECTURE**9 Hrs**

Automated Test Equipment (ATE) System Components - Digital Pin Electronics - Drive data formats - Digital High way - Analog Highway - Test Vector Generation - Creating test patterns - Fault Simulations. Technique - Bus Cycle Signature System - Board functional test methods - Design for Testability.

UNIT V COMPUTER VISION IN AUTOMATED PCB TESTING**9 Hrs**

Elements of Computer vision - Image Acquisition- Image Pre-processing-Component Detection and Text recognition methods-Template matching- Faster RCNN - Software Tools for Computer Vision- OpenCV, Tensorflow and Keras

Course Outcomes

On completion of the course, the student will be able to

CO1- Identify various types of printed circuit boards and effectively use testing tools

CO2- Perform manual trouble shooting of assembled PCBs.

CO3- Identify faults in assembled PCBs using automated test equipment both at component level and board level

CO4- Design board fixtures to carry out customized board level testing

CO5- Develop test vectors and test patterns for fault identification in custom PCBs

CO6- Apply computer vision techniques in automated electronic testing

TEXT / REFERENCE BOOKS

- 1 Michael L.Bushnell et al., "Essentials of Electronic testing for digital, memory and mixed signal VLSI circuit", 1st edition, Academic Press, 2018.
- 2 Parag.K.lala, "Digital circuit Testing and Testability", 2nd edition, Academic press, 2015.
- 3 Alfred L.Crouch, "Design for test for Digital ICs and Embedded core systems", 3rd edition, PHI, 2010.
- 4 Sabapathy S.R., "Test Engineering for electronic hardware", Qmax publishers, 1st Edition, 2007
- 5 Steve Holden "Computer Vision: Advanced Techniques and Applications" Clanrye International, 1st Edition, 2019.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 12 marks**80 Marks**

SECA4002	DEEP LEARNING NEURAL NETWORKS	L	T	P	Credits	Total marks
		3	0	0	3	100

COURSE OBJECTIVES

- To present the mathematical, statistical and computational challenges of building neural networks
- To study the concepts of deep learning
- To introduce dimensionality reduction techniques
- To enable the students to know deep learning techniques to support real-time applications
- To examine the case studies of deep learning techniques

UNIT I INTRODUCTION TO DEEP LEARNING**9 Hrs.**

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT II DEEP NETWORKS**9 Hrs.**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning

UNIT III DIMENSIONALITY REDUCTION**9 Hrs.**

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures - AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization

UNIT IV OPTIMIZATION AND GENERALIZATION**9 Hrs.**

Optimization in deep learning- Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

UNIT V APPLICATIONS OF DEEP LEARNING**9 Hrs.**

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions

Max: 45 Hours**Course Outcomes**

On completion of the course, the student will be able to

- CO1 - Select suitable model parameters for different machine learning techniques
- CO2 - Evaluate the performance of existing deep learning models for various applications
- CO3 - Realign high dimensional data using reduction techniques
- CO4 - Analyze the performance of various optimization and generalization techniques in deep learning
- CO5 - Modify the existing architectures for domain specific applications
- CO6 - Develop a real time application using deep learning neural networks

TEXT / REFERENCE BOOKS

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A :** 10 Questions of 2 marks each – No choice**20 Marks.****PART B :** 2 Questions from each unit of internal choice; each carrying 16 marks**80 Marks.**

SECA4003	DRONE ELECTRONICS	L	T	P	Credits	Total Marks
		3	1	0	3	100

COURSE OBJECTIVES

- To Introduce The Concepts Of Applying Aerodynamics To Drone Design
- To Familiarize The Student's Ability To Analyze The Concepts Of Drone
- To Understand The Basic Operation Of Various Sensors In Drone Application
- To Design Drone For The Mission Control Application

UNIT I INTRODUCTION TO DRONE**9 Hrs.**

Definition of drones , History of drones , Classification of drones based on structure- Fixed wing structure, Lighter than air systems and Rotary-wing aircraft, Application of drones, Parts of Drone system, System design, Mechanical design, hardware design, software architecture, Logistic and Operations Management

UNIT II DYNAMICS AND STABILITY**9 Hrs.**

Forces of flight, Principal axes and rotation of aerial systems - Longitudinal axis, Lateral(transverse) axis and Perpendicular axis, Equilibrium, Stability - Stable system, Unstable system and Neutrally stable system, Control - Roll, Pitch, Yaw and Throttle.

UNIT III SENSORS IN DRONE**9 Hrs.**

Sensors - Accelerometer, Barometer, Gyro Sensor, Magnetometer, Distance sensors , Time of Flight (ToF) Sensors, Thermal sensors, Chemical Sensors and thermal sensors. Sensor Testing - Test Philosophies and methodologies, Test equipment, Performance testing of sensors

UNIT IV GLIDING DRONES**9 Hrs.**

Glider, Lift, Drag, Airfoil and its type, Incident and decalage angle, Three axis motion (roll, pitch, and yaw), Thrust, Aspect ratio and glide ratio, Glide or dive and descent, gliding angle, Climb, Center of pressure, Pitching moment, Load factor, Angle of attack, Build our own glider drone.

UNIT V DRONES FOR MISSION CONTROL APPLICATIONS**9 Hrs.**

ESP8266, Downloading and installing APM Planner or Mission Planner, Configuring the quadcopter - Frame type selection, Compass calibration, Access calibration, Radio calibration, Flight mode calibration and Failsafe calibration, Surveying with a drone, tweaks with the Flight Plan screen. Future of Drone Systems

Maximum Hours: 45**Course Outcomes**

On completion of the course, the student should be able to

- CO1 - Apply the mathematical/engineering concepts in building drones
 CO2 -Analyze the mathematical relation between force, equilibrium, stability and the movement of drones
 CO3 - Select appropriate sensors and actuators for specific applications
 CO4 - Design gliding drones for real world applications
 CO5 - Appraise the performance of subunits in drones
 CO6 - Design a drone for mission control application.

TEXT / REFERENCE BOOKS

1. Syed Omar Faruk Towaha, "Building Smart Drones with ESP8266 and Arduino: Build exciting drones by leveraging the capabilities of Arduino and ESP8266" Packt Publishing, 2018
2. Aaron Asadi, "Drones The Complete Manual. The essential handbook for drone enthusiasts", Imagine Publishing Limited, 2016
3. Neeraj Kumar Singh, Porselvan Muthukrishnan, Satyanarayana Sanpini, "Industrial System Engineering for Drones: A Guide with Best Practices for Designing", Apress, 2019
4. Felipe Gonzalez Toro, Antonios Tsourdos, "UAV or Drones for Remote Sensing Applications"2018.
5. K R Krishna, "Agricultural Drones: A Peaceful Pursuit", Apple Academic Press; CRC Press, 2018

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3****Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 12 marks**80 Marks**

SECA4004	e-Health	L	T	P	Credits	Total marks
		3	1	0	3	100

Course Objectives

- To introduce the concepts of eHealth
- To have an in-depth knowledge on medical data analytics and wearable devices used in e-Health systems
- To assess the advantages of eHealth
- To explore the usage of AI in eHealth
- To design and develop applications for e-Health

UNIT I INTRODUCTION TO e-Health**9 Hrs**

Overview and introduction to eHealth and flow of health information- International regulations in e-Health-Advantages, Challenges and future of e-Health.

UNIT II MEDICAL DATA ANALYTICS AND WEARABLE DEVICES**9 Hrs**

Health care data and Electronic Health Records (EHR) systems- Medical data bases -Wearable devices-Data collection from wearable devices- Clinical use of personal health data- Big data in the field of Medicine.

UNIT III DIGITAL HEALTH**9 Hrs**

Introduction to health care digital transformation- Digital health: Tools, Strategies of digital health- Technologies in digital health-Implementation of Digital health- Advantages and challenges of Digital health

UNIT IV ARTIFICIAL INTELLIGENCE IN e-Health**9 Hrs**

History of AI in health care-Impacts and Aspects of AI in health care- Current research in AI in e-Health-Regulations and Ethical concerns in using AI in e-Health

UNIT V APPLICATION DEVELOPMENT FOR e-Health**9 Hrs**

Introduction to Android, Creating Android Activities, Android User interface design, Access Wi-fi and Bluetooth with mobile applications-Web based App for eHealth applications.

Max: 45 Hrs**Course Outcomes**

On Completion of The Course, Student Should Be Able To

- CO1 - Articulate e-Health and Its Regulations
- CO2 - Explore Medical Data Analytics and Records
- CO3 - Appraise Digital Transformation in The Field of Medicine
- CO4 - Analyse AI in Health Care Systems
- CO5 - Design System Level Architecture for Health Information Systems
- CO6 - Deploy Android Application on Devices

TEXT / REFERENCE BOOKS

- Shortliffe, Edward H and Cimino James J. Biomedical Informatics, Computer Applications in Health Care and Biomedicine, Springer-Verlag London 2014.
- Lavis, JN (ed). Ontario's Health System: Key Insights for Engaged Citizens, Professionals and Policymakers. 2016.
- Hoyt RE, Yoshihashi A, Bailey N. Health informatics: Practical guide for healthcare and information technology professionals. Lulu Press. 2014 Seventh edition.
- Gaddi A, Capello F, Manca M. eHealth, Care and Quality of Life. 2014 electronic library holding in the Health Science Library

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3****Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 12 marks**80 Marks**

SECA4005	INDUSTRIAL INTERNET OF THINGS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

- To focus on basics of Industrial Internet
- To modify the various existing industrial systems
- To get an idea about IIoT Architectures
- To acquire the knowledge about various Network Protocols
- To extract the backend Middleware Protocols

UNIT I Introduction to Industrial Internet**9 Hrs**

Innovation and IIoT - Intelligent Devices - Industrial Internet - Health care -Oil and Gas Industry - Smart Office - Logistics - IoT Innovations in Retail.

UNIT II Technical and Business Innovators of Industrial Internet**9 HRS**

Miniaturization - Cyber Physical Systems - Wireless technology - IP Mobility - Network Functionality Virtualization - Cloud and Fog - Big Data and Analytics - M2M Learning and Artificial Intelligence

UNIT III IIoT Reference Architecture**9 Hrs**

Industrial Internet Architecture Framework - Functional Viewpoint - Operational Domain, Information Domain, Application Domain, Business Domain - Implementation View point - Architectural Topology - Three Tier Topology - Data Management.

UNIT IV Industrial Internet Systems**9 Hrs**

Introduction-Proximity Network Protocols - WSN Edge Node - Legacy Industrial Protocols -RS232 Serial Communications, 40-20ma Current Loop, Field Bus Technologies - Modern Communication Protocols - Industrial Ethernet - Industrial Gateways.

UNIT V Middleware Transport Protocol**9 Hrs**

TCP/IP, UDP, RTP, CoAP -Middleware Software patterns -Software Design patterns - Application Programming Interface (API) - CAN Protocol-Web Services - Middleware IIoT - Securing the IIoT- Identity Access Management.

Max. 45 Hrs**Course Outcomes**

On completion of the course, the student should be able to

- CO1 -Enhance the company's performance using IoT
- CO2 -Demonstrate the different styles of technical and business innovators
- CO3 -Examine various IIoT Architectures related to data management system
- CO4 -Organize the design of Industrial Internet Systems
- CO5 -Select various Software design patterns using API
- CO6 -Construct a Middleware software system related to proximity edge networks.

Text/Reference Books

1. S. Misra, A. Mukherjee, and A. Roy, Introduction to IoT. Cambridge University Press, 2020
2. S. Misra, C. Roy, and A. Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.2020
3. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies Sensors for the Internet of Things Businesses & Market Trends 2014 -2024', Yole Development Copyrights ,2014
4. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 12 marks**80 Marks**

SECA4007	REAL-TIME SYSTEM DESIGN	L	T	P	Credits	Total marks
		2	0	2	3	100

Course Objectives

- To explain the features of real-time applications.
- To learn different task scheduling algorithms for real-time systems.
- To discuss various fault-tolerance techniques available for real-time systems.
- To learn about real-time operating systems and their characteristics.
- To study about various software tools for development of real-time embedded systems

UNIT I INTRODUCTION TO REAL-TIME SYSTEMS 9 Hrs

Real-time system characteristics-Hard real-time and soft real-time systems -Timing Constraints-Modelling Timing Constraints of typical real-time systems- Safety airbag - Aircraft Flight controller.

UNIT II REAL-TIME TASK SCHEDULING 9 Hrs

Task Modelling -Types of Schedulers - Preemptive and Non-Preemptive scheduling - Cyclic schedulers- Rate Monotonic Algorithm (RMA-Earliest Deadline First Algorithm (EDFA)- Handling Resource sharing among real-time tasks - Priority Inversion - Priority Inheritance and Priority Ceiling Protocol for Deadlock prevention.

UNIT III REAL-TIME OPERATING SYSTEMS 9 Hrs

Introduction to RTOS -Survey of real-time OS:Vxworks, QNX, Micrium OS, RT Linux and freeRTOS - Creating Tasks -Multitasking using RTOS - Interprocess Communication using mailbox, message queues - Task Synchronisation and Resource management using semaphores-Timers and Interrupts in RTOS-Memory Management in RTOS

UNIT IV REAL-TIME SYSTEM MODELING 9 Hrs

Model based system design frameworks - Petrinets and applications in real-time modeling, Vending Machine - Air traffic controller system - Distributed air defense system- Evaluation of system performance - In the loop Testing - Hardware in the loop testing-Software in loop testing

UNIT V CASE STUDY OF REAL-TIME SYSTEMS 9 Hrs

Real-time PID controller-Real-time Multimedia communication-Real-time Databases-Aircraft Avionics-ECU in Automobiles

Max: 45 Hrs**Course Outcomes**

On completion of this course, students are able to

- CO1- Identify timing constraints of real-time systems
- CO2- Apply appropriate scheduling algorithms for timely execution of real-time tasks
- CO3- Develop real-time applications using RTOS
- CO4- Apply model based design approach for given real-time application
- CO5- Apply fault tolerant design techniques in developing real-time systems.
- CO6-Evaluate performance of real-time systems using model based design frameworks.

TEXT / REFERENCE BOOKS

1. Philip. A Laplante, "Real Time System Design and Analysis", Prentice Hall of India, 4th Edition.2012.
2. Jane W. S Liu, "Real Time Systems" Pearson Higher Education, 4th Edition, 2014.
3. Richard Barry, "Mastering the Free RTOS: Real Time Kernel", Real Time Engineers Ltd, 1st Edition, 2016.
4. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill, 2nd Edition, 2014.
5. Warren Gay, "Beginning STM32: Developing with Free RTOS",Apress, 1st Edition, 2018.
6. Li Q, Yao C, "Real-Time Concepts for Embedded Systems", CMP Books, 1st Edition, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 12 marks**80 Marks**

SEC1626	System Programming	L	T	P	Credits	Total Marks
		4	0	0	4	100

COURSE OBJECTIVES

This course is meant to give them a broad exposure to the understanding of various concepts of System Programming.

The course will provide the students with

- (i) the concept of advanced Embedded C Language,
- (ii) the knowledge of microcontroller architecture,
- (iii) the methodology to write Program for chosen microcontroller, and
- (iv) the skill to use basic technique for debugging in Linux environment and
- (v) basic understanding of system programming.

Experiments will run in synchronism with the lectures to support the methods and techniques taught in the lectures. Through the experiments, the students will

- (i) learn how to use Linux commands and programming environment,
- (ii) gain confidence to do system programming in Linux environment, and learn how to test and debug the developed programs.

Learning Outcome of students are

- (i) Perform advanced C programming using linked list, Function pointers, arrays, sorting, etc.,
- (ii) Basic scripting in Linux environment
- (iii) Demonstrate programming using Linux System calls
- (iv) Demonstrate various debugging techniques when the program throws error
- (v) Plan and execute projects simple system programming projects.

UNIT 1 EMBEDDED C PROGRAMMING**9Hrs.**

Essential C Programming Concepts, Variables and Constants, IO operation, Memory Layouts, Operators and Expression, Control Statements, Functions, Arrays, Pointer, Structure and Union, Debugging Methods.

Lab work

1. Programs to understand the various C memory layouts and variable storage locations.
2. Programs to understand the control and conditional statements extensively.
3. Programs to understand the passing of 1-D, 2-D arrays to functions as argument.
4. Programs to understand the pointer usage and passing argument by reference.
5. Programs to understand the structure, union, enum, typedef and bitwise logical operations.

Project

1. Projects based on the modular programming design.
2. Projects based on event handlers
3. Projects based on finite state machine

UNIT 2 EMBEDDED SYSTEM SOFTWARE**9Hrs.**

Assembly and C Microcontroller Programming, IO Port Programming, Timer Programming, Handling Interrupts, Interfacing with external peripherals and memory, ADC Programming, LCD & Keypad Programming, Interfacing with Sensors.

Lab work

1. Programs to understand the GPIO input, output and alternate functionalities.
2. Programs to understand the timer functionalities in the microcontroller.
3. Programs to understand various interrupts and interrupt service handler and interrupt service routines.
4. Programs to understand the external interrupts and external peripheral interface with the microcontroller.
5. Programs to understand the ADC and DAC interfaces with the microcontroller.
6. Programs to understand the display and keypad interfaces with the microcontroller.
7. Programs to understand the external sensor signal handling in the microcontroller.

Project

1. Constructing the circuit in the breadboard to execute the lab work exercises in the actual hardware.
2. Developing programs for microcontroller with modular programming using state machines approaches.

UNIT3 EMBEDDED LINUX SYSTEM PROGRAMMING**9Hrs.**

System Programming Concepts, File Operation Programming, IO Operation Programming, Advance Process Management Programming and Thread Programming and Mutex.

Lab work

1. Programs to understand the file management in Linux C.
2. Programs to understand the process handling in Linux C.
3. Programs to understand the threads and mutex in Linux C.

Project

1. Developing multi processes project in Linux C.
2. Developing project using threads and mutex.

UNIT 4 EMBEDDED LINUX SYSTEM PROGRAMMING IPCs**9Hrs.**

Essential Inter Process Communication and Synchronization, Pipes, Signals, Timers, Shared Memory, Message Queues and Semaphores.

1. Programs to understand the Pipes in Linux C.
2. Programs to understand the Signals and Timers in Linux C.
3. Programs to understand the Shared Memory and Semaphores in Linux C.
4. Programs to understand the Message Queues in Linux C.

Project

1. Developing event-based project using Linux IPC and synchronization mechanism.
2. Developing message queue-based project using message queue and synchronization mechanism.

UNIT 5 ADVANCE MICROCONTROLLER PROGRAMMING

9Hrs.

Introduction of Advanced Microcontroller Architectures, Buses, Memory, Clock Tree, Reset, Interrupts Management, IOs, Timers, and external interfaces.

Lab work

1. Programs to understand the various clock configurations.
2. Programs to understand the timer configurations and event handlers.
3. Programs to understand various interrupts and interrupt service handler and interrupt service routines.
4. Programs to understand the external interrupts and external peripheral interface with the microcontroller.
5. Programs to understand the handling of external signals.

TEXT BOOK/ REFERENCE BOOKS

Text Books:

Advanced Embedded C Programming
The C Language Programming, Brian W. Kernighan, Dennis M. Ritchie, 1998.
Linux System Programming
Linux System Programming, Robert Love, 2013.
Advanced Microcontroller Programming
Discovering the STM32 Microcontroller, Geoffrey Brown, 2012.

Reference Books:

Advanced Embedded C Programming

1. THE FIRMWARE HANDBOOK, Jack Ganssle, 2004..
2. C Programming for Embedded Systems, Kirk Zurell, 2000.
3. Making Embedded Systems, Elecia White, 2011.

Linux System Programming

1. Beginning Linux Programming, Neil Matthew & Richard Stones, 2008.
2. Hands-On System Programming with Linux, Kaiwan N Billimoria, 2018.

Advanced Microcontroller Programming

1. Mastering STM32, Carmine Noviello, 2016.
2. ARM Cortex M4 Cookbook, Dr. Mark Fisher, 2016.
3. RM0090, Reference manual, STM32F405/415, STM32F407/417, STM32F427/437 and STM32F429/439 advanced Arm®-based 32-bit MCUs.
4. PM0214 Programming manual STM32 Cortex-M4 MCUs and MPUs programming manual.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3Hrs.

SEC1627	EMBEDDED LINUX BSP & PERFORMANCE TUNING	L	T	P	Credits	Total Marks
		2	1	0	3	100

COURSE OBJECTIVES

This course focusses on applying the topics learned in 6th and 7th semester for a real-world application, expands the understanding of the components that make up an embedded system.

The course will provide the students with

- (vi) Advanced C skills and exposure to C++
- (vii) The core concepts of boot loader, BSP and performance tuning
- (viii) Substantiate the previous learnings of C programming and device drivers,
- (ix) The methodologies for debugging and performance tuning

UNIT 1**APPLICATIONS of 'C' & C++ BASIC****9Hrs.**

Advanced C: Compiler - linker - loader, ELF, Static and Dynamic Libraries, Structure, Union and Bit field Structure, Pointers, Arrays, Multi-dimensional Arrays, Double pointers, Function Pointers, Memory Allocation, linked list, Queue and Stack, Hash table, Data structure algorithms, Makefiles. C++ basic: Classes & Objects, C++ Pointers & Arrays, Constructors & Destructors, Overloading, Inheritance, Virtual functions, Polymorphism, Exception handling, Templates, CMAKE.

UNIT 2**APPLICATIONS of LINUX SYSTEM PROGRAMMING****9Hrs.**

Industrial Protocols Overview: CAN, Modbus, Profibus, EtherCAT, CoAP, Advanced Process Management: Scheduler Types, Priorities, Affinity, Hard Vs Soft Real-time Systems, Advanced Thread Management: Revisiting Thread Models, Patterns, Concurrency, Parallelism, Races, Synchronization and Pthread.

UNIT 3**APPLICATIONS of DEVICE DRIVERS****9Hrs.**

PCI: PCI Vs PCI-X Vs PCIe, PCI Architecture, Memory and IO map, Configuration Space, Enumeration, Block drivers, DAS/NAS/SAN Overview, Storage Architecture. Ethernet Driver: Ethernet boot loader driver, Ethernet Linux driver, Ethernet tools & tests, Raw socket, General Device Drivers1: Memory, RTC, Sensors, Power rails, General Device Drivers2: Timers, ADC, IOs using PINCTRL, Waveforms using PWM, High level tests for Audio & Video

UNIT 4**EMBEDDED LINUX BSP****9Hrs.**

Boot Loader: Introduction, Device tree, Arguments, Boot sequence, Drivers, Optimizations, U-boot commands, Accessing boot environments from user space. Board Support Package: of a BSP, Toolchain, build system, Booting Linux locally and from remote, Booting Ubuntu with a new Kernel, Booting with plain vanilla Kernel, Core dumps, Busy box.

UNIT 5**DEBUGGING & PERFORMANCE TUNING****9Hrs.**

Introduction, Methods and Concepts, Boot parameters, /proc, /Sys and Sysctl, System Monitoring, Timer counter, Memory Management (swap, page, defragmentation), Tuning - memory/Network/Device usage, Controlling Process - Threads, Profiling and Benchmarking methods, Debugging Methods and Techniques – CRO and Logic Analyzers, JTAG, Problem Reproduction, Dumps, Break point, Single Step, variables and history analysis, Print statement, Interrupt, I/O points, Instrumenting code, Code Tracing & Coverage.

COURSE OUTCOMES

On completion of the course the student will be able to

Learning Outcome of students are

- CO1: Become well versed in C and exposed to C++
- CO2: Applying PCI device driver knowledge for a Storage use case
- CO3: Understanding of Bootloader and BSP components
- CO4: Understanding of build systems
- CO5: Demonstrate building a custom Linux distribution
- CO6: Demonstrate various debugging and performance tuning techniques

TEXTBOOK/ REFERENCE BOOKS

1. Peter D Hipson, Advanced C, Sams Publishing, 1982
2. John Perry, Advanced C programming by Example, PWS, 1982
3. Andrew and Barbara, Accelerated C++ Practical Programming by Example, Addison-Wesley, 2000.
4. Robert Love, Linux System Programming, 2nd Edition, O'Reilly Media, Inc. 2013
5. Michael Kerrisk, The Linux Programming Interface: A Linux and UNIX System Programming Handbook, No Starch Press, 2010

SECA3020	5G COMMUNICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

- To learn about wireless mobile communication standards and co-existence of 4G and 5G.
- To learn 5G network architecture, components, features and their benefits.
- To learn channel access methods, modulation and spectrum sensing techniques used in 5G wireless systems.
- To understand advanced wireless concepts such as Massive MIMO, Virtualized RAN and Network Slicing.
- To learn about mmWave communication systems and its use cases.

UNIT I**INTRODUCTION TO 5G****9 Hrs**

3G and 4G(LTE) overview- Introduction to 5G – Use Cases - Evolving LTE to 5G Capability- 5G NR and 5G core network (5GCN) - 5G Standardization - 3GPP and IMT2020 - Spectrum for 5G – 5G deployment - Options, Challenges and Applications.

UNIT II**5G CHANNEL ACCESS METHODS****9 Hrs**

OFDM and OFDMA – MIMO OFDM – Generalized Frequency Division Multiplexing (GFDM) – Non-Orthogonal Multiple Access (NOMA) - Universal Filtered OFDM -Filter bank multicarrier (FBMC)- Sparse Code Multiple Access (SCMA) – Comparison of multiple access methods

UNIT III**RADIO ACCESS NETWORK FOR 5G NR****9 Hrs**

5G NR requirements - 5G Core Network Architecture - Radio-Access Network (RAN)- Radio Protocol Architecture -User Plane Protocols-Radio Link Control - Medium-Access Control – Physical Layer functions -Control Plane Protocols - Network Slicing- RAN virtualization-Spectrum Management in 5G.

UNIT IV**CHANNEL MODELS FOR 5G NR****9 Hrs**

Channel Hierarchy in 5G NR – Logical Channels and Transport Channels in 5G NR - Physical Layer Data Channels in 5G NR - Downlink Physical Channel and Uplink Physical Channels - Propagation Channel models for 5G.

UNIT V**ENABLING TECHNOLOGIES FOR 5G****9 Hrs**

Device-to-Device (D2D) Communication - 5G for Massive Machine Type Communication and Massive IoT- V2X Communication - Full Duplex and Green Communication - mmWave Communications -Massive MIMO and Beamforming Techniques.

COURSE OUTCOMES

On completion of the course the student will be able to

- CO1 - Distinguish major mobile communication standards such as 3G, 4G and 5G
- CO2 - Analyze various modulation and multiplexing techniques like OFDM, NOMA etc.
- CO3 - Design system level architecture of 5G communication systems.
- CO4 - Analyze spectrum sensing and sharing techniques in 5G systems.
- CO5 - Assess the potential of mmWave spectrum for 5G applications.
- CO6 - Apply the concepts of green communications in real life applications.

TEXT/REFERENCE BOOKS

1. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies, CRC Press, 1st Edition, 2019.
2. Erik Dahlman, Stefan Parkvall, Johan Skold "5G NR: The Next Generation Wireless Access Technology", Academic Press, 1st Edition, 2018.
3. Jonathan Rodriguez, "Fundamentals 5G Mobile Networks", John Wiley & Sons, 1st Edition, 2015.
4. Long Zhao, Hui Zhao, Kan Zheng, Wei Xiang, "Massive MIMO in 5G Networks: Selected Applications", Springer, 1st Edition, 2018.
5. Robert W. Heath Jr., Angel Lozano, "Foundations of MIMO Communication", Cambridge University Press, 1st Edition, 2019.
6. R. Vannithamby and S. Talwar, "Towards 5G: Applications, Requirements and Candidate Technologies", John Wiley & Sons, 1st Edition, 2017.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 12 marks**80 Marks**

SECA3028	MACHINE LEARNING TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

- To Recognize Different Key Paradigms For Machine Learning Concepts
- To Familiarize With Various Classifiers Used For Machine Learning
- To Understand And Differentiate Among Various Supervised Learning Concepts
- To Become Familiarize With Data Reduction And Feature Extraction Methods
- To Apply Suitable Machine Learning Algorithms For Simple Engineering Problems

UNIT I INTRODUCTION TO MACHINE LEARNING**9 Hrs**

Machine Learning vs Statistical Modelling, Applications of Machine Learning, Supervised vs Unsupervised Learning, Supervised Learning Classification, Unsupervised Learning Classification, Python libraries suitable for Machine Learning.

UNIT II CLASSIFIERS**9 Hrs**

Classification, K- nearest neighbour, Decision Trees, Implementing Decision Tree, building a Tree, Random Forests - Working of Random Forest, Pros and Cons of Random Forest, Naiver Bayes, building model Using Naiver Bayes

UNIT III SUPERVISED LEARNING**9 Hrs**

Regression, Types of Regression model, Building a Regressor in Python, Types of ML Algorithm, Linear Regression, Multiple Linear Regression, Non-linear Regression, Model evaluation methods.

UNIT IV K-MEANS CLUSTERING**9 Hrs**

Working of K-Means Clustering Algorithm, Advantages and Disadvantages, Applications of K-Means Clustering Algorithm, Hierarchical Clustering, Steps to Perform Agglomerative Hierarchical Clustering, Role of Dendrograms Agglomerative Hierarchical Clustering, Density-Based Clustering.

UNIT V ML MODELS AND COMPUTATIONAL LEARNING**9 Hrs**

Parameter Estimation, sufficient statistics, decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers, N-gram models; Markov and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, locally weighted regression, ensemble classifiers. Computational Learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting

Maximum Hours: 45**COURSE OUTCOMES**

On completion of the course the student will be able to

- CO 1 - Classify supervised and unsupervised learning
- CO 2 - Apply appropriate machine learning strategies for any given problem
- CO 3 - Recommend supervised and unsupervised learning algorithms for any given problem
- CO 4 - Apply the Bayesian concepts to machine learning
- CO 5 – Evaluate existing machine learning algorithms
- CO 6 - Develop an appropriate machine learning approach for Real World Problems

TEXT/REFERENCE BOOKS

1. Chris Albon : Machine Learning with Python Cookbook , O'Reilly Media, Inc.2018
2. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014
3. Tom M. Mitchell, Machine Learning, India Edition 2013, McGraw Hill Education
4. Machine Learning: The art and Science of algorithms that make sense of data, Peter Flach, Cambridge University Press, 2012
5. EthemAlpaydin, Introduction to machine learning, second edition, MIT press.
6. T. Hastie, R. Tibshirani and J. Friedman, "Elements of Statistical Learning", Springer Series , 2nd edition
7. Sebastian Raschka, "Python Machine Learning", Second Edition. Packt Publication

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 12 marks**80 Marks**

SECA3027	IoT FOR REAL TIME APPLICATIONS	L	T	P	Credits	Total Marks
		2	0	2	3	100

Course Objectives

- To design products related to IoT based Health care applications
- To design IoT enable smart cities considering various energy harvesting techniques
- To develop IoT based system for supporting farmers and agriculture
- To develop IoT based system for industrial automation
- To analyze various IoT based system considering societal benefits
- To develop an IoT based wearable device for measuring physiological parameters and physical movements

UNIT I IoT FOR HEALTHCARE**9 Hrs.**

Architecture of IoT for Healthcare , IoT based Health Monitoring System using Arduino, Healthcare monitoring Technique for Diabetes Patients, Remote Patient Monitoring- IoT Heart Rate Monitoring, remote monitoring of physiological parameters, ECG, EEG, and BP.

UNIT II IoT ENABLED SMART CITIES**9 Hrs**

Smart Energy meters, , Smart home powered by IoT, Smart Lightning, Smart Traffic Control ,Smart Grid and Solar Energy Harvesting, Intelligent Parking System.

UNIT III IoT FOR SMART AGRICULTURE**9 Hrs.**

Smart Agriculture, IoT Based Agriculture, Animal Intrusion detection in farms, soil moisture detection and Irrigation system, Livestock monitoring system, IoT based Greenhouse Environment Monitoring and controlling

UNIT IV IoT BASED INDUSTRIAL AUTOMATION**9 Hrs.**

IoT based gas leakage monitoring system, Temperature and liquid level monitoring in boilers, Wireless video surveillance robot, Automatic Solar Tracker, IoT in Logistics Sector

UNIT V IoT FOR SOCIETY**9 Hrs.**

Medical Waste Management, Weather update system with IoT, Women security system, wearable glove to enable sign to speech conversation, IoT based air pollution meter, Improved productivity of staff and reduced human labor

Maximum Hours: 45**Course Outcomes**

On completion of the course, the student should be able to

- CO1-Develop MATLAB programs for solving basic mathematical problems
- CO2-Develop MATLAB programs for solving Real World Problems
- CO3-Develop GUI and MATLAB programs for Plotting various types of Graphs
- CO4-Develop MATLAB programs for Advanced Mathematical applications
- CO5-Develop Simulink based systems for solving Real World Problems
- CO-6 Develop Simulink programs for resolving specialized engineering related issues

TEXT / REFERENCE BOOKS

1. Fadi Al-Turjman, Intelligence in IoT- enabled Smart Cities, 2019, 1st edition, CRC Press, ISBN-10: 1138316849
2. Giacomo Veneri, and Antonio Capasso, Hands-on Industrial Internet of Things: Create a powerful industrial IoT infrastructure using Industry 4.0, 2018, Packt Publishing.
3. Krishna P. Venkata, Sasikumar Gurumoorthy, Mohammad S.Obaidat, Internet of Things and Personalized Healthcare Systems , Springer-2019.
4. Pattnaik, Prasant Kumar, Mohanty, Suneeta, Mohanty, Satarupa, Smart Healthcare Analytics in IoT Enabled Environment, Springer-2020.
5. Avijit Mathur, Thomas Newe, Walid Elgenaidi, Muzaffar Rao, Elfed Lewis and Daniel Toal, Medical IoT systems: architecture and security by Wearable Sensors, 2017.
6. Verónica Saiz-Rubio , Francisco Rovira-Mas ,From Smart Farming towards Agriculture 5.0: A Review on Crop Data Management, Agronomy 2020, 10, 207; doi:10.3390/ agronomy 10020207

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 Hrs.****PART A:** 10 Questions of 2 marks each - No choice**20 Marks****PART B:** 2 Questions from each unit of internal choice; each carrying 12 marks**80 Marks**

SECA1406	INDUSTRY 5.0 FOR ELECTRONICS ENGINEERS	L	T	P	Credits	Total Marks
		2	0	2	3	100

OBJECTIVES

- To acquaint with the digital transformation of Industry 5.0
- To recognize the power of industry to achieve societal goals beyond jobs and growth
- To understand the design of personalized electronics products
- To focus on methods of interaction between humans and machines
- To develop the concept of electronics manufacturing beyond automation and optimization

UNIT 1**INDUSTRY 4.0****9 Hrs.**

Introduction to Industry 4.0, Industry 4.0: The Fourth Industrial Revolution, History of Industry 4.0, Industry 4.0 by definition, Component of Industry 4.0, The opportunities in Industry 4.0, Industrial Internet, Smart Factory, Smart Buildings, Smart Manufacturing, Smart Farming.

UNIT 2**INDUSTRY 5.0****9 Hrs.**

Evolution from Industry 1.0 to 5.0, Introduction to Industry 5.0, Globalization and Emerging Issues, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories, Healthcare and Human computer interactions, Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Big Data and Advanced Analysis.

UNIT 3**DIGITAL TRANSFORMATION TO SOCIETY 5.0****9 Hrs.**

Digital Transformation, Introduction to Digital Transformation, Digital business transformation, Causes of disruption and transformation, Digital transformation myths and realities, Digital transformation across various industries, Retail industry, Urban Development, e-Governance and the public sector, Insurance industry, Healthcare, Food, Manufacturing, Disaster Control, Elements of Society 5.0, Data Driven to Society, Humanity Vs Society 5.0.

UNIT 4**SMART WORLD****9 Hrs.**

Introduction: Sensing & actuation, Communication, Electronics in Smart city, 5G Technology, Communication protocols, Integration of Sensors in Robots and Artificial Intelligence, Human-Machine Interaction, Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management., Intellectual Property Rights- Case Studies - Milk Processing and Packaging Industries.

UNIT 5**CYBER SECURITY IN INDUSTRY 5.0****9 Hrs.**

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Intellectual Property Rights (IPR) : Case Studies- Augmented Reality Virtual Reality

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 – Identify the digital transformation power of Industry 5.0 to achieve societal goals beyond jobs and growth
- CO2 – Analyze enhanced new production models in electronics
- CO3 – Implement various electronics manufacturing technologies beyond automation and optimization
- CO4 – Design suitable sensors for smart world real time applications
- CO5 – Evaluate the performance of various cyber physical systems
- CO6 – Create personalized electronics products combining the various industry 5.0 Applications with deep knowledge on Intellectual Property Rights

TEXT / REFERENCE BOOKS

1. S. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press. Availability: https://www.amazon.in/Introduction-to-IoT-Sudip-Misra/dp/1108959741/ref=sr_1_1?dchild=1&keywords=sudip+misra&qid=1627359928&sr=8-1.
2. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press. Availability: https://www.amazon.in/dp/1032146753/ref=sr_1_3?dchild=1&keywords=sudip+misra&qid=1627359971&sr=8-3
3. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
4. Oliver Grunow, "SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies", Studylab Publications, 2016.
5. Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016.

S13AEPICS	Engineering Projects in Community Service	L	T	P	Credits	Total marks
						100

Course Objectives

To Properly define and scope a problem;

To Identify and analyze relevant factors;

To apply appropriate industrial engineering methodologies and computational tools;

To Generate and evaluate alternative solutions;

To Improve skills in

▪ Technical writing, ▪ Public speaking, ▪ Working within a team (when applicable), and ▪ Project and time management.

Unit I	Multidisciplinary Design: Learn how to be better designers, gain design knowledge and skills; learn how to apply disciplinary knowledge to real and possibly ill-defined problems; learn how to identify and acquire new knowledge; learn to collaborate with people from other disciplines and develop an appreciation for cross-disciplinary contributions in design.	9 Hrs
Unit II	Professional Preparation: Develop the broad set of skills needed to be successful in the changing global workplace and world:	9 Hrs
Unit III	Service-Learning: Provide significant service to the community while learning; gain an understanding of the role that engineering (and their discipline) can play in society and the broader issues related to the needs we are addressing.	9 Hrs
Unit IV	Case studies on community service	9 Hrs
Unit V	Identification of engineering solutions to a real world problem	9 Hrs

The students will be able

CO1: To investigate the real -world problems

CO 2: To illustrate the real -world problems with community service

CO 3: To demonstrate design the solutions using multi- disciplinary approach

CO 4: To investigate the processes

CO 5: To analyze the solutions given

CO 6: To develop empathy

SEC1205	ELECTRONIC CIRCUITS - I	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 RECTIFIERS AND POWER SUPPLIES 9 hrs

Half Wave Rectifier - Full Wave Rectifier - Bridge Rectifier - Performance of Rectifiers - Filters - Types of Filters - L, C, LC, π Filters - Ripple Factor Calculation for C, L, LC and π Filter - Regulators - Shunt and Series Voltage Regulator - IC Regulator - SMPS

UNIT 2 TRANSISTOR BIASING CIRCUITS AND SMALL SIGNAL ANALYSIS OF BJT AMPLIFIERS 9 hrs

Biasing- Types of biasing- DC equivalent circuit of BJT- Load Line-DC and AC Load Line Analysis - Hybrid Model of BJT- Hybrid Model Analysis of CE, CB, CC - Calculation of Input Impedance, Output Impedance, Voltage Gain, Current Gain using hybrid model- Approximate Model of BJT- CE, CB and CC Analysis- Small signal equivalent circuit of BJT- Small Signal Analysis of CE, CB and CC.

UNIT 3 SMALL SIGNAL ANALYSIS OF FET AND MOSFET AMPLIFIERS 9 hrs

Biasing of FET Amplifiers- Types- Small Signal Model of FET- Small Signal Analysis of CS-CD-CG FET- Calculation of Input Impedance-output impedance-voltage gain using small signal model- MOSFET Biasing-Types-Small Signal Model of MOSFET-Small Signal Analysis of CS-CD-CG MOSFET- Calculation Input Impedance-output impedance-voltage gain using small signal model

UNIT 4 FREQUENCY RESPONSE AND MULTISTAGE AMPLIFIERS 9 hrs

Frequency Resonance- Low Frequency response and High Frequency Response equivalent circuit analysis of BJT- Low Frequency response and High Frequency Response equivalent circuit analysis of FET- Miller's Effect - Multistage amplifiers-need for multistage amplifiers- methods of interconnecting multistage amplifiers - Types of Multistage amplifiers - Analysis of RC coupled Amplifiers -Analysis of Direct Coupled Amplifiers-Analysis of Transformer Coupled Amplifiers-cascade amplifier- Cascade amplifier- Darlington Emitter Follower Amplifier

UNIT 5 LARGE SIGNAL AMPLIFIERS 9 hrs

Class A power amplifier with resistive and transformer coupled load- calculation of efficiency- Class B-Push pull-complementary symmetry - efficiency calculation- Class C Power Amplifier- Class AB operation and Class D type of operation- distortion in power amplifiers - Thermal stability of power amplifier

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Compare the various types of Rectifiers and Filters
CO2	Categorize the Biasing circuits of the Transistor
CO3	Analyze the Hybrid model equivalent circuit and small signal analysis of amplifiers
CO4	Derive the frequency response characteristics of BJT and FET based amplifiers
CO5	Determine the characteristics and efficiency of Power amplifiers
CO6	Construct the multistage amplifier circuits

TEXT / REFERENCE BOOKS:

1. Gupta. J.B, "Electronic Devices and Circuits", Katson Publishers, 2009
2. Singh Ravish R " Electronic Circuits I", Pearson Education Publisher; First edition 2012
3. Donald .A. Neamen, " Electronic Circuit Analysis and Design" –2nd Edition, Tata Mc Graw Hill, 2009
4. David A. Bell, " Electronic Devices and Circuits", Oxford Higher Education Press, 5th Edition, 2010
5. Gupta. J.B, "Electronic Devices and Circuits", Katson Publishers, 2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1206	ELECTRONIC CIRCUITS - II	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1	FEEDBACK AMPLIFIERS Basic concept of feedback-Types of Feedback - Properties of negative feedback - Basic Feedback Topologies - Types of negative feedback connection - effect of negative feedback on stability, noise, distortion, gain, input and output impedance, bandwidth- analysis of voltage and current feedback amplifier	9 hrs
UNIT 2	OSCILLATORS Condition for Oscillation (Barkhausen Criterion) -Classification of Oscillators -General form of LC Oscillator - Analysis of LC Oscillator, Colpitts, Hartley, Clapp, Armstrong, Crystal Oscillator - Analysis of RC Oscillator, RC Phase Shift Oscillator - Wein Bridge Oscillator	9 hrs
UNIT 3	TUNED AMPLIFIERS Resonance Circuits, Unloaded and Loaded Q of Tank Circuit - Bandwidth - Types of Tuned Amplifiers - Analysis of Capacitive coupled and inductive coupled Single Tuned Amplifier - Double Tuned Amplifier-Stagger Tuned Amplifier - Instability of Tuned Amplifier -Stabilization Techniques, Neutralization and Unilaterlization - Class C Tuned Amplifiers	9 hrs
UNIT 4	WAVE SHAPING AND MULTI VIBRATOR CIRCUITS High Pass RC, RL Circuits and their Response for Step, Ramp and Exponential signal -Low Pass RC, RL Circuits and their Response for Step, Ramp and Exponential signal - Multivibrators- Collector Coupled Astable, Monostable,Bistable Multivibrators and Schmitt Trigger Circuits	9 hrs
UNIT 5	TIME BASE GENERATORS AND BLOCKING OSCILLATORS Principle of Time Based Generator - Voltage Time Based Generator -Current time Based Generator- Astable Blocking Oscillator using Emitter Timing -Astable Blocking Oscillator using Base Timing-Monostable Blocking Oscillator using Emitter Timing- Monostable Blocking Oscillator using base Timing	9 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Design the feedback amplifiers
CO2	Design the oscillator circuits
CO3	Design the different types of Tuned amplifiers
CO4	Analyze the wave shaping and Multivibrator circuits
CO5	Analyze the blocking oscillators
CO6	Discuss the time base circuits

TEXT / REFERENCE BOOKS:

1. Mithal G.K, "Electronic Devices and Circuits", Khanna Publishers, 23rd Edition, 2008
2. David A. Bell, "Solid State Pulse Circuits", PHI, 2008
3. Anil K.Maini and Varsha Agarwal,"Electronic Devices and Circuits ",Wilsey,2009
- 4."Electroni Devices and circuits "Jacob Millman and Chriseos C.Halkias Tata McGraw Hill, 2012
5. Sedra and Smith, "Micro Electronic Circuits"; Sixth Edition, Oxford University Press, 2011

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SCS4201	OBJECT ORIENTED PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:

- | | | |
|----|--|-------|
| 1 | Develop a C++ program to implement a class, object creation, member function invocation concept | 4 hrs |
| 2 | Develop a C++ program to implement the various constructors and destructor concept | 3 hrs |
| 3 | Develop a C++ program to implement a friend function, Inline function | 3 hrs |
| 4 | Develop a C++ program to implement an operator (Unary & Binary) overloading concept | 5 hrs |
| 5 | Develop a C++ program to implement a function overloading concept | 3 hrs |
| 6 | Develop a C++ program to implement a run time polymorphism | 4 hrs |
| 7 | Develop a C++ program to implement the following inheritance types:
a. Single
b. Multiple
c. Multilevel
d. Hierarchical
e. Hybrid | 6 hrs |
| 8 | Develop a C++ program to implement an Abstract class concept. | 4 hrs |
| 9 | Develop a C++ program to implement a Virtual function. | 4 hrs |
| 10 | Develop a C++ program to find the number of characters in a file | 4 hrs |
| 11 | Develop a C++ program to handle the exceptions. | 5 hrs |

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects
CO2	Explain the difference between object-oriented programming and procedural oriented language and data types in C++
CO3	Describe dynamic memory management techniques using pointers, constructors, destructors, etc.
CO4	Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
CO5	Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
CO6	Develop program using C++ features such as composition of objects, Operator overloading, inheritance, Polymorphism etc

SCS1202	OBJECT ORIENTED PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION TO OBJECT ORIENTED PROGRAMMING 9 hrs

Object Oriented Programming Paradigms - Comparison of Programming Paradigms - Basic Object Oriented Programming concepts - Comparison with C - Overview of C++ - Pointers - Functions - Scope and Namespaces -Source files and programs

UNIT 2 CLASSES AND OBJECTS 9 hrs

Working with classes - Classes and objects - Class specification - Defining class members – Objects Accessing member functions - Inline Functions - Data hiding - Class member accessibility - Empty classes

UNIT 3 CONSTRUCTORS AND OVERLOADING 9 hrs

Default constructors - Parameterized constructors - Constructor overloading - Copy constructors - new, delete operators-"this" pointer - friend classes and friend functions - Function overloading- Unary Operator overloading -Binary Operator overloading

UNIT 4 INHERITANCE 9 hrs

Base class and derived class relationship - Derived class declaration - Forms of inheritance - Inheritance and member accessibility - Constructors in derived class - Destructors in derived class - Multiple inheritance – Multilevel inheritance - Hybrid inheritance - Virtual base classes - Member function overriding - Virtual functions – Abstract classes - Pure Virtual functions

UNIT 5 I/O AND LIBRARY ORGANIZATION 9 hrs

I/O Stream - File I/O - Exception Handling - Templates - STL - Library Organization and Containers – Standard Containers -Overview of Standard Algorithms - Iterators and Allocators

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the basic features of C++
CO2	Describe the concept of data abstraction and encapsulation
CO3	Analyze C++ classes for code reuse
CO4	Implement copy constructors and class member functions
CO5	Implement dynamic binding with polymorphism
CO6	Implement generic classes with C++ templates

TEXT / REFERENCE BOOKS:

1. Balagurusamy, "Object Oriented Programming with C++", Tata McGraw Hill, 6th Edition, 2013
2. Mahesh Bhavde, Sunil Patekar Object Oriented Programming with C++", Tata McGraw Hill, 2012
3. Bjarne Stroustrup, "C++ Programming Language", Pearson Education, 2014

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1208	SIGNALS AND SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1	CLASSIFICATION OF SIGNALS Continuous time signals(CT signals)and Discrete time signals(DT signals)-Basic operations on signals-elementary signals-Step, Ramp, Pulse, Impulse, Exponential-Classification of CT and DT systems-Periodic and Random signals, Real and complex signals-Energy and Power signals.	9 hrs
UNIT 2	ANALYSIS OF CONTINUOUS TIME SIGNALS Continuous time Fourier Transform –Properties of CTFT-Inverse Fourier Transform-Unilateral and bilateral Laplace Transform analysis with examples-Basic properties- Parseval's relation-Convolution in time and frequency domain-Relation between Fourier transform and Laplace transform-Fourier series analysis.	9 hrs
UNIT 3	LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEM Concept of CT systems-Linear time invariant Systems-Basic properties of continuous systems-Linearity,Causality,Time invariance, Stability-Frequency response of LTI systems-Analysis and characterization of LTI systems using Laplace transform-Differential equation -Computation of impulse response ,step response, natural response, forced response, frequency response and transfer function --Convolution integral-Properties of Convolution Integral.	9 hrs
UNIT 4	ANALYSIS OF DISCRETE TIME SIGNALS Spectrum of DT signals, Discrete Time Fourier Transform(DTFT)-Properties of DTFT-z transform-Basic Properties of Z transform -Region of Convergence-Properties of ROC- -Poles and Zeros-Inverse z transform using contour integration-Residue theorem, power series expansion and partial fraction expansion method-Relation between Z-transform and DTFT.	9 hrs
UNIT 5	LINEAR TIME INVARIANT DESCRETE TIME SYSTEMS Concept of LTI-DT Systems-Properties and types of LTIDT systems-Causality, stability,invertibility,time invariant, linearity- interconnection of LTI Systems-Difference equation- Computation of impulse response ,step response, natural response ,forced response, frequency response and transfer function –Convolution sum using matrix, graphical and tabulation method-properties of convolution sum.	9 hrs

COURSE OUTCOMES:

On completion of this course, student will be able to

CO1	Explain the basic concept of signals and systems, the basic mathematical operations on Continuous Time (CT) and Discrete Time (DT) signals
CO2	Analyze the suitability of Laplace transform and Fourier transform in CT signals
CO3	Evaluate the response of Linear Time invariant systems
CO4	Examine the suitability of Z transform, DTFT in DT signals
CO5	Categorize the different domain transformation and evaluate the various system responses
CO6	Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling

TEXT / REFERENCE BOOKS:

1. Allen V. Oppenheim et al, "Signals and Systems", 2nd Edition, Prentice Hall of India. Ltd, 1997
2. P. Ramesh Babu et al. "Signals and Systems, 4th Edition, SciTech Publishers, 2010
3. Haykin. S and Van Beem. B. "Signals and Systems", 2nd Edition, John Wiley & Sons, 2003
4. Rao. P, "Signals and Systems", 1st Edition, Tata McGraw Hill, 2008
5. Mrinal Mendal, Amir Asif, "Continuous and Discrete Time signals", Cambridge University Press 2007
6. Roberts, M.J. "Fundamentals of Signals and Systems", 1st Edition, Tata McGraw Hill 2007
7. S. Salivahanan et al, "Digital Signal Processing", 2nd Edition Tata McGraw Hill, 2009
8. H P Hsu, "Signals and Systems", 2nd Edition, Tata McGraw Hill, 2008
9. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford University Press, 2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SEC1213	PROBABILITY THEORY AND RANDOM PROCESS	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT1 **PROBABILITY THEORY** **12 hrs**
 Probability Theory: Random experiment, Definition of probability, Axioms of Probability, Probability Space, Conditional Probability, Bayes Theorem (without proof), Concept of a Random Variables (Discrete and Continuous), Functions of Random Variables (One dimensional).

UNIT 2 **RANDOM VARIABLES** **12 hrs**
 Probability Distributions: Discrete distributions: Binomial distribution, Poisson distribution, Geometric distribution (problems only). Continuous Distributions: Uniform distribution, exponential distribution, Normal distribution (problems only).

UNIT 3 **RANDOM PROCESS** **12 hrs**
 Two Dimensional Random Variables : Two dimensional random variables, probability functions(x,y) , Joint probability density functions, Marginal and conditional probability distributions, Independent random variables, Transformation of two dimensional random variables

UNIT 4 **DISCRETE PARAMETER MARKOV CHAINS** **12 hrs**
 Random Process: Random Process concept, Classification of random process, Stationary process, strict sense stationary process, Wide sense stationary processes, Poisson Process (Problems only) , Auto correlation and its properties (problems only).

UNIT5 **CONTINUOUS PARAMETER MARKOV CHAIN** **12 hrs**
 Queuing Theory : Introduction to Concept of Queuing Models -Symbolic representation of a queuing model, characteristic of queuing system, single server models (M/M/1):(∞/FCFS) and (M/M/C):(∞/FCFS) - Multiple server Models (M/M/1):(N/FCFS) and (M/M/C):(N/FCFS)- Problems only.

COURSE OUTCOMES:

On completion of this course, students are able to -

CO1	Appraise various probability distribution functions
CO2	Evaluate several probability values involving two dimensional random variables
CO3	Predict the properties of random processes and its various types
CO4	Create State classification and Pollaczek-Khinchin transform equation
CO5	Analyse Markovian model queueing systems with multi server and infinite/finite capacity
CO6	Develop continuous parameter Markov chain

TEXT / REFERENCE BOOKS

1. T. Veerarajan, "Probability, statistics and Random Processes", Tata McGraw-Hill Publishing Company Ltd., 2005
2. J. Medhi, "Stochastic Processes", New Age International (P) Ltd., Third Revised Edition, 2010

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1313	DIGITAL COMMUNICATIONS (For ECE and ETCE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 SAMPLING AND QUANTIZATION**9 hrs**

Review of Sampling process -Natural Sampling-Flat Sampling - Aliasing - Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise Bandwidth -Noise trade off-PCM- Noise considerations in PCM- differential pulse code modulation - Delta modulation -Linear prediction - Adaptive Delta Modulation

UNIT 2 BASEBAND PULSE TRANSMISSION**9 hrs**

Base band transmission - Wave form representation of binary digits -Matched filter- error rate due to noise -- Nyquist's criterion for distortion less base band binary transmission- Inter symbol interference - ideal Nyquist channel - Raised cosine channels- correlative level coding - Baseband M-ary pam transmission- equalization - Eye patterns- companding - A law and μ law- Correlation receiver

UNIT 3 DIGITAL MODULATION TECHNIQUES**hrs**

Introduction - ASK- FSK - PSK- coherent modulation techniques-BFSK-BPSK-signal space diagram-robability of error-coherent quadrature modulation techniques- QPSK-signal space diagram-probability of error- non coherent modulation techniques-M-ary modulation techniques - Vectorial view of MPSK and MFSK - error performance

UNIT 4 SYNCHRONIZATION**9 hrs**

Synchronization: Receiver synchronization - Coherent systems - Symbol and frame synchronization - Network synchronization - Open and closed loop transmitter synchronization - Tracking and acquisition in spread spectrum system

UNIT 5 SPREAD SPECTRUM MODULATION**9 hrs**

Pseudo- noise sequences - a notion of spread spectrum - Direct sequence spread spectrum with coherent binary phase shift keying - Signal space Dimensionality and processing gain -Probability of error - Frequency -hop spread spectrum- Use of spread spectrum with code division multiple access

Max. 45 hrs**COURSE OUTCOMES:**

On completion of this course, students are able to

CO1	Describe the working of digital communication systems and different source encoding schemes
CO2	Analyze the degradation in Baseband Pulse Transmission and techniques to overcome it
CO3	Compare the performance of different digital modulation techniques with different modulation schemes in the presence of noise
CO4	Analyze the performance of various synchronization schemes in digital communication receivers
CO5	Evaluate the performance of spread spectrum based digital communications systems
CO6	Design modulator and demodulator for digital communication systems

TEXT / REFERENCE BOOKS:

1. Simon Haykin, Michael Moher, "Communication Systems" John Wiley, 5th Edition, March 2009
2. Herbut Taub, Donald L. Schilling, Goutam Saha, "Principles of Communication", 4th McGraw Hill edition, 2013
3. John G. Proakis, Masoud Salehi, "Digital Communication", McGraw Hill 5th edition, 2014
4. Bernard Sklar, "Digital Communication, Fundamentals and Application", Pearson Education Asia, 3rd Edition, 2013

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SCS1315	COMPUTER ARCHITECTURE AND OPERATING SYSTEM	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION**9 hrs**

Central Processing Unit - Introduction - General Register Organization - Stack organization -- Basic computer Organization - Computer Registers - Computer Instructions - Instruction Cycle. Arithmetic, Logic, Shift, Micro operations- Arithmetic Logic Shift Unit -Example Architectures: MIPS, Power PC, RISC, CISC

UNIT 2 CONTROL UNIT DESIGN AND MULTIPROCESSORS**9 hrs**

Micro programmed Control: Control memory - address sequencing - Micro program Example- Design of Control unit -Example Processor design Multiprocessors: Characteristics- Interprocessor Arbitration- Interprocessor Communication

UNIT 3 MEMORY AND I/O SYSTEM**9 hrs**

Memory Organization: Memory Hierarchy - Main memory - auxiliary Memory - Associative Memory - Cache Memory - Virtual memory Input - Output Organization: Peripheral Devices - I/O Interface, Modes of transfer – Priority Interrupt - DMA -IOP - Serial Communication

UNIT 4 INTRODUCTION**9 hrs**

Introduction - Operating system structures - System components - OS services - Process Management: Processes – Process concepts - Process scheduling-- CPU scheduling- Scheduling algorithms - Preemptive strategies - Non-preemptive strategies

UNIT 5 DEADLOCKS AND MEMORY MANAGEMENT**9 hrs**

The critical section problem - Semaphores - Deadlocks - Deadlock characterization - Prevention – Avoidance – Detection - Recovery. Storage Management Strategies - Contiguous vs. non-contiguous storage allocation- Paging - Segmentation - Paging/Segmentation systems - Page replacement strategies

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the micro level dataflow in various units of computer
CO2	Demonstrate the impact of control memory operations and multi-processor characteristics
CO3	Examine the different types of memory and experimenting the mapping techniques
CO4	Select the suitable process scheduling technique for optimized function of operating systems
CO5	Critically appraise the deadlock in CPU and other memory management techniques
CO6	Develop an optimized architecture for stand-alone applications

TEXT / REFERENCE BOOKS:

1. M.Morris Mano, "Computer System Architecture", Prentice-Hall Publishers, Third Edition,2007
2. John P Hayes, 'Computer Architecture and Organization', McGraw Hill international edition, Third Edition,2007
3. Kai Hwang and Faye A Briggs, 'Computer Architecture and Parallel Processing', McGraw Hill International edition.
4. Abraham Silberschatz,Peter Galvin and Gagne, "Operating System Concepts", 6th Edition, Addison Wesley, 2002
5. Harvey M.Deitel, "Operating System", 2nd Edition, Addison Wesley, 2000

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1301	ANTENNAS AND WAVE PROPAGATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 FUNDAMENTALS OF ANTENNA**9 hrs**

Basic concepts of Retarded Potentials - Antenna Fundamentals and Physics - Radiation from an alternating current element, Half wave Dipole, quarter wave mono pole - Fields, Power radiated and Radiation Resistance - Antenna Parameters(definition only): Field Patterns, Gain and Directivity, Effective Length, Effective Aperture, Radiation Resistance, Antenna Terminal (self and mutual) Impedance, Polarization, Beam width, Bandwidth

UNIT 2 ANTENNA ARRAYS**9 hrs**

Arrays of two point sources. Linear arrays of point sources - Direction of Maxima, Direction of Minima and Beam Width- Types of arrays - Broad side, End fire, Collinear, Parasitic arrays. Pattern Multiplication - Binomial arrays

UNIT 3 SPECIAL PURPOSE ANTENNAS (QUALITATIVE TREATMENT ONLY)**9 hrs**

Antennas for low, medium and high frequencies. Effects of earth on radiation patterns of antennas. **Practical antennas and methods of excitation.** Loop antennas, Traveling Wave antennas - V and rhombic antennas, Folded Dipole, Reflector antennas, Yagi arrays and its applications. Slot radiators, Horn antennas, Parabolic Antenna, Lens Antenna and Wide band antennas - Log-periodic antennas and its applications. **Analysis of rectangular and circular micro strip antenna. Smart antennas for mobile communications.** Antenna for infrared detectors

UNIT 4 PROPAGATION**9 hrs**

Factors involved in the **propagation of Radio Waves. The ground wave, ionosphere and its effects on radio waves-** Mechanism of Ionospheric propagation. Refraction and Reflection of sky wave by the ionosphere, Ray paths, skip distance, Maximum usable frequency, Fading of signals. Selective fading-Diversity reception. Space wave propagation, Considerations in space wave propagation. Atmospheric effects in space wave propagation. Super Refraction - Duct Wave Propagation

UNIT 5 MEASUREMENTS**9 hrs**

Measurement of Impedance, Field/Radiation Pattern and gain of antennas, Measurement of Directivity, Measurement of Antenna efficiency-Antenna Radiation Efficiency, Aperture Efficiency Ionospheric measurements - Vertical incidence measurements of the ionosphere - Relation between oblique and vertical incidence transmission - **System Issues - antenna noise design**

COURSE OUTCOMES:

On completion of this course, students are to

CO1	Analyze the various types of antenna elements
CO2	Construct and develop antenna array structures
CO3	Analyze the various types of antenna and its structure development
CO4	Assess the characteristics of free space propagation
CO5	Evaluate the performance of radio wave propagation
CO6	Examine the various antenna parameters

TEXT / REFERENCE BOOKS:

1. C A Balanis, "Antenna Theory Analysis and Design", 3rd Edition, John Wiley Publishers, 2005
2. Robert E.Collin, "Antennas and Radio wave propagation", McGraw Hill, 2002
3. F.E.Terman, "Electronic and Radio Engineering", Mc Graw Hill book company, 2004
4. H.Sizun "Radio Wave Propagation for Telecommunication Applications", First Indian Reprint, Springer Publications, 2007
5. J.D. Kraus, R.J. Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation"– McGraw hill education, New Delhi, 4th ed., (Special Indian Edition), 2010
6. K.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, PHI, 2007
7. A. R Harish and M. Sachidananda, Antennas and Wave Propagation, Oxford University Press, 2011

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1210	TRANSMISSION LINES AND WAVE GUIDES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1	TRANSMISSION LINE THEORY Introduction - Types of transmission lines - General theory of transmission line - Line constants – Transmission line equation - Physical significance of the equations - The Infinite line - Distortion in a line - Distortion-less line -Telephone cables - Loading of lines - Types of loading - Campbell's formula - General equation for line with any termination - Input impedance - Open and Short circuited line. Numerical problems	9 hrs
UNIT 2	RADIO FREQUENCY TRANSMISSION LINES Line approximations - Parameters of open wire line at radio frequency, parameters of coaxial lines at radiofrequencies, constants for the line of zero dissipation - Voltages and Currents on the dissipation-less lines – input impedance of a lossless line - Wavelength and velocity of propagation - Reflection phenomena - Line losses – Return loss - reflection loss- insertion loss.- Reflection coefficient, Reflection factor, Standing wave ratio, Input impedance in terms of reflection coefficient - Practical types - Microwave Transmission line, Super Conducting transmission line, Characteristics of different printed transmission lines	9 hrs
UNIT 3	MATCHING, MEASUREMENTS AND INTERFERENCE Types of transmission line sections - Half wave line - One eighth wave line - Quarter wave line - Properties of quarter wave transformer - Location of Vmax and Vmin - Impedance matching - Single and double stub matching- Smith chart - Solutions of problems using smith chart - Applications of smith chart - Measurement of line parameters-Measurement of VSWR, Wavelength, Impedance and Power - Phenomenon of corona, Methods of reducing corona and interference	9 hrs
UNIT 4	ELECTROMAGNETIC WAVES Waves between parallel planes - Transverse electric waves -Transverse magnetic waves - characteristics of TE and TM waves - Transverse electromagnetic waves - Velocities of propagation - Attenuation in parallel plane waves - Wave impedance	9 hrs
UNIT 5	GUIDED WAVES AND WAVEGUIDE THEORY Rectangular wave guides - TE and TM waves in rectangular wave guides - Dominant mode - Cut off frequency in wave guides - Impossibility of TEM waves in wave guides - Circular wave guides- TE and TM waves in circular wave guides - Attenuation factor and Q of wave guides-Microwave resonators introduction - rectangular cavity resonator - Q-factor of micro wave cavities	9 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Classify various types of transmission lines
CO2	Describe the various transmission line parameters
CO3	Demonstrate the usage of transmission line at low and high frequency conditions
CO4	Analyze the behavior of transmission line using Smith chart conditions
CO5	Evaluate the characteristics of parallel plane and rectangular wave guides
CO6	Design and implement the characteristics of Circular wave guides and resonators

TEXT / REFERENCE BOOKS:

1. K.A. Gangadhar, "Electromagnetic Field Theory (Including Antenna Wave Propagation", Khanna Publisher New Delhi, 2009
2. Karl.E.Lonngrén, Sava.V.Savov, "Fundamentals of Electromagnetics with MATLAB", PHI, 2009
3. William Hayt, "Engineering Electromagnetics", Tata McGraw - Hill, New York, 7th Edition, 2012
4. R.Meenakumari & R.Subasri, "Electromagnetic Fields", New Age International Publishers, 4th Edition, 2010
5. E.C.Jordan & K.G.Balmain, "Electromagnetic Waves & Radiating Systems", Prentice- Hall, 2013

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1209	ANALOG COMMUNICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

- UNIT1 BASICS OF ELECTRONIC COMMUNICATION AND NOISE THEORY** **9 hrs**
 Review of time and frequency domain description of signals - Communication system: point to point and broad cast - Basic model of a communication system: transmitter, receiver and channel - Fundamental limitations: Technological, Physical; Noise, bandwidth (signal and channel) and information capacity - Need for modulation and types - classification of communication based on modulation and channel - Base band and Pass band transmission - Electromagnetic spectrum allocation for various communication systems. Noise in Communication systems: Types and sources of noise; Atmospheric Noise, Thermal Noise, Shot noise, Partition noise, Flicker noise, Transit time noise - noise factor, noise factor for cascaded amplifier (Friss formula) -Noise figure - Equivalent noise temperature and bandwidth - Signal to Noise Ratio
- UNIT 2 AMPLITUDE MODULATION AND DEMODULATION** **9 hrs**
 STD-AM (DSB-FC) Mathematical representation - waveform, frequency spectrum, bandwidth, power relations and Modulation index - Multi tone modulation - Limitations and Modifications in STD-AM: DSB-SC, SSB-SC and VSB, AM Generation (Modulators): DSB-FC; square law modulator, Collector and base modulator circuits - DSB- SC; Balanced modulator circuit using BJT/FET - SSB: Phase shift method and Filter method - VSB; Filter method- Application and Comparison of various AM schemes - AM transmitter: Low and high level Modulation. AM Detection (Demodulators) - Envelope detector, Significance of RC time constant - Square law detector - Costa's PLL detector
- UNIT 3 ANGLE (FM & PM) MODULATION AND DEMODULATION** **9 hrs**
 Single tone FM: Mathematical representation, waveform, frequency spectrum, modulation index, bandwidth and power - Multi-tone FM - Types and comparison of FM: Narrowband and Wideband - Compare FM and AM Phase modulation (PM): Mathematical representation and waveform - Relation between FM and PM - Conversion: FM to PM and PM to FM - Application of FM and PM. FM Generation: Direct method using Varactor diode and indirect method (Armstrong modulator) - Pre-emphasis - FM stereo broadcast transmitter. FM Detector: Balanced slope detector, Foster seelay frequency discriminator and Ratio detector - De- emphasis
- UNIT 4 ANALOG PULSE MODULATION, DEMODULATION AND MULTIPLEXING** **9 hrs**
 Analog pulse modulation - Sampling theorem - Nyquist rate - Concepts of PAM, PWM (PDM) and PPM - Modulators and demodulators. Multiplexing- classifications: Frequency Division Multiplexing, Time Division Multiplexing and Quadrature Multiplexing - Comparison of multiplexing
- UNIT 5 RECEIVERS AND SYSTEMS** **9 hrs**
 AM Receivers: TRF receivers -Super heterodyne receivers: choice of IF, double conversion technique, tracking, AGC- characteristics of receiver - noise in AM receiver. FM Receivers: FM stereo broadcast receivers - AFC - Noise in FM - Capture effect, FM threshold effect. Communication Receivers: Sensitivity, fidelity and selectivity - Squelch circuit - Beat frequency Oscillator- Overview of Telephony, Telegraphy, Television, CCTV and Cable television

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the functional blocks of communication system, noise sources and types
CO2	Derive the mathematical equations and demonstrate the generation & detection of AM, FM, PM, PAM, PDM and PPM
CO3	Design AM and FM transmitters
CO4	Apply sampling theorem and demonstrate the significance of various multiplexing techniques
CO5	Analyze the TRF and Super heterodyne receivers and concepts of Telephony, Telegraphy, Television, CCTV and Cable television
CO6	Develop appropriate modulation technique for real time applications

TEXT / REFERENCE BOOKS:

1. Dennis Roody and John Coolen, Electronic Communication, Pearson, 4/e, 2011
2. Tomasi, Electronic Communications System, Pearson, 5/e, 2011
3. Simon Haykin, —Communication Systems||, Wiley Publication, New Delhi, 2011
4. Kennedy G, - Electronic Communication systems, Tata McGraw Hill, New Delhi, 2009
5. Sanjay Sharma, “Analog Communication Systems”, 2009
6. B. P. Lathi, Modern digital and analog Communication systems, Oxford University Press., 4th edition, 2010

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1302	ANALOG INTEGRATED CIRCUITS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION TO OP- AMP AND ITS APPLICATIONS**9 hrs**

OP-AMP– DC and AC Characteristics- Input offset voltage- Input bias current-Input offset current- Total output offset voltage- Thermal drift- Slew rate- CMRR -Inverting amplifier- Non-inverting amplifier- Voltage follower- Summing and differential amplifier- Integrator- Differentiator- Logarithmic and Anti logarithmic amplifiers- Comparator and Schmitt trigger

UNIT 2 FILTERS AND SIGNAL GENERATORS**9 hrs**

First order and Second order Butterworth filters- low pass, high pass, band pass and band reject filters – RC phase shift, Wein's bridge oscillator- Astable and Monostable multivibrator-Precision half wave and full wave rectifiers

UNIT 3 A/D AND D/A CONVERTERS**9 hrs**

Sample and Hold circuit – Digital to analog converters: R-2R ladder network and Binary weighted – Characteristics of D/A converters – Analog to digital converters: Flash converter – Successive approximation converter – Dual slope ADC.

UNIT 4 PLL AND TIMER CIRCUITS**9 hrs**

Phase Locked Loop IC 565– Block schematic – Applications of PLL: FM demodulator and Frequency synthesizer- FSK Demodulator- VCO IC LM 566 – Timer IC LM 555 and its applications: Astable and Monostable multivibrator

UNIT 5 SPECIAL FUNCTION ICs**9 hrs**

Integrated circuit Tuned amplifier, Instrumentation Amplifier, Series and shunt voltage regulator, Opto coupler, CMOS Operational Amplifier- Dc analysis- small signal analysis- specifications of IC MC 14573

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Interpret the DC-AC Characteristics and applications of Operational Amplifier
CO2	Design the Active filters using OP-AMP
CO3	Develop a voltage controlled oscillator for PLL application
CO4	Examine the applications of special function IC's namely voltage Regulator and 555 timer
CO5	Analyze ADC and DAC for Real time Implementation
CO6	Implement a research oriented application using OPAMP

TEXT / REFERENCE BOOKS:

1. D.Roy Choudary, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd., 2000
2. Grey and Meyer, Analysis and Design of Analog Integrated Circuits, 4th Edition, Wiley International, 2001
3. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition, Tata Mc Graw-Hill, 2007
4. S. Salivahanan, V.S. Kanchana Bhaaskaran, " Linear integrated circuits", 3rd Edition, McGraw-Hill, 2011
5. William D.Stanely, Operational Amplifiers with Linear Integrated Circuits, 4th Edition, Pearson Education, 2004
6. D. Choudhari, S. Jain "Linear Integrated Circuits", New Age International (P) limited, 4th edition, 2010
7. Sedra A. S. and K. C. Smith, Microelectronic Circuits, 6/e, Oxford University Press, 2013

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1303	COMMUNICATION SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 TELEPHONE COMMUNICATION**9 hrs**

Telephones – Standard Telephone and local loop – Electronics Telephone – Telephone System– Cordless Telephone – Telephone Facsimile – Fax Machine Operation – Paging System –Cellular Telephone system – Digital cellular Telephone system – ISDN transform- Inverse Z transform-System transfer Function

UNIT 2 TELEVISION COMMUNICATION**9 hrs**

Television – Basic Principles – Scanning – Camera tubes – band width consideration – generation of composite video signals– monochrome and color transmitter – Picture tubes – receivers – Flat screen TV – Digital TV – HDTV - Set top box

UNIT 3 SATELLITE COMMUNICATION**9 hrs**

Satellite basics – Orbit dynamics – Types of Satellite Orbits – Satellite system – System calculation – satellite sub system and earth station sub system – Satellite Frequency band –Satellite Applications – Noise in satellite communication system – multiple access method – FDMA and TDMA system

UNIT 4 RADAR COMMUNICATION**9 hrs**

RADAR basics – RADAR block diagram and operation – Range equation –RADAR scanning system – Types of RADAR – Doppler effect CW radar – FM CW radar – MTI radar– Pulsed radar – tracking – detection of radar signals in noise – correlation detection

UNIT 5 WIRELESS COMMUNICATION**9 hrs**

Review of IEEE standards – Bluetooth – Piconet – Bluetooth Usage models – Bluetooth Architecture - IR –Ultrasonic– Ultrasonic Production – Applications of Ultrasonic - RF- WiFi- ZigBee - ZigBee Architecture – ZigBee Network Topologies

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Compare the different types of Telephone systems
CO2	Illustrate the functional parts of Monochrome, Colour and Digital TV
CO3	Examine the Satellite system performance under different conditions
CO4	Analyze the performance of various RADAR Communication systems
CO5	Interpret wireless communication standards
CO6	Propose block level communication system design for given application

TEXT BOOK:

1. Louis. E. Frenzel, "Communication Electronics Principles and applications", 3rd Edition, Tata McGraw Hill Publications, 2002

REFERENCE BOOKS:

1. Dennis Roody and John Coolen, Electronic Communications, 4th edition, Prentice Hall of India, 2002
3. Merill I Skolnik, Introduction to Radar Systems, 3rd Edition, Mc Graw Hill 2002
4. R.Gulati, Monochrome and colour television, 2nd Edition, New age international 2005
5. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press, 2007
6. B.Sklar, "Digital Communications Fundamentals and Applications", 2nd Edition, Pearson Education 2007

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SEC1314	DIGITAL SIGNAL PROCESSING	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 INTRODUCTION TO SIGNALS AND SYSTEMS**12 hrs**

Representation, Characterization and Classifications of Continuous Time (CT) & Discrete Time (DT) signals, Sampling theorem - Aliasing effect, Operations on DT signals, **Convolution**, Advantages of DSP over ASP, Classification of CT & DT systems, properties of Discrete time systems-Linearity-Time invariance- causality –stability-Linear time Invariant systems, Difference equation representation of LTI systems-The Z transform- properties of Z transform- Inverse Z transform-System transfer Function

UNIT 2 DISCRETE FOURIER TRANSFORM (DFT) AND FAST FOURIER TRANSFORM (FFT)**12 hrs**

DFT and its properties, Relation between **DTFT and DFT, FFT computations** using Decimation in time (DIT) algorithms and Decimation in frequency (DIF) algorithms, Auto correlation, Cross correlation, and their properties. Realization of Discrete Time System: introduction, Basic Realization block diagram and the signal flow graph, Realization of recursive and non recursive systems - Direct Form I and Form II - Cascade and parallel realization

UNIT 3 DIGITAL FILTER DESIGN**12 hrs**

Design of Digital Filters: General considerations: causality and its implications, characteristics of practical frequency selective filter. Design of FIR filter using window method - Rectangular, Hanning and Hamming Windows. Design of IIR filters using Impulse invariant and Bilinear transformation method. Review of Butterworth and Chebyshev approximations, Frequency selective filters: Ideal filter characteristics, low pass, high pass and band pass filters, Properties of IIR and FIR filters

UNIT 4 FINITE WORD LENGTH EFFECTS**12 hrs**

Fixed point and floating point number representations - Comparison - Truncation and Rounding errors - Quantization noise - derivation for quantization noise power -coefficient quantization error - Product quantization error - Overflow error - Round off noise power - limit cycle oscillations due to product round off and overflow errors -signal scaling

UNIT 5 MULTIRATE SIGNAL PROCESSING**12 hrs**

Introduction to Multirate signal processing-Decimation-Interpolation- Poly phase implementation of FIR filters for interpolator and decimator -Multistage implementation of sampling rate conversion- Design of narrow band filters-Applications of Multirate signal processing, **Speech compression, Adaptive filter, Musical sound processing, Image enhancement.**

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the various types of signals and systems and its operations
CO2	Apply various transforms for different types of signals
CO3	Design IIR & FIR filter using various filter approximations
CO4	Make use of the concept of finite word length effects and its applications in signal processing
CO5	Elaborate the concept of Multirate signal processing
CO6	Explain the perception of Multirate signal processing in real time applications

TEXT / REFERENCE BOOKS:

1. John G. Proakis & Dimitris G. Manolakis, "Digital Signal Processing - Principles, Algorithms & Applications", Fourth Edition, Pearson education / Prentice Hall, 2009
2. Sanjit K. Mitra, Digital Signal Processing: A Computer - Based Approach, McGraw-Hill Education, 4th edition, 2013
3. B.P. Lathi, "Signal Processing & Linear systems", Oxford University Press, 2nd edition, 2009
4. Lyons, "Understanding Digital Signal Processing", Prentice Hall, 3rd edition, 2010
5. Johny R. Johnson, "Introduction to Digital Signal Processing", PHI, 2006
6. Alan V. Oppenheim, Ronald W. Schaffer, Discrete-Time Signal Processing, Pearson, 3rd Edition, 2010
7. Salivahanan, "Digital Signal Processing, 2nd Edition, TMH, 2010

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEE1203	CONTROL SYSTEMS	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 SYSTEM CONCEPTS

14 Hrs.

Types of System - Open Loop Systems, Closed Loop Systems, Basic Elements in Control System - Mathematical Models of Physical System: Differential Equation- Transfer Functions of Single Input, Single Output and Multi Variable Systems - Simple Electrical Networks, Electrical Analogous of Mechanical Translational and Rotational System - D.C and A.C Servomotor - Mechanical System- Translational and Rotational System - Block Diagram Reduction Techniques - Signal Flow Graphs - Mason's Gain Formula.

UNIT 2 TIME RESPONSE ANALYSIS OF CONTROL SYSTEMS

10 Hrs.

Standard Test Signals -Time Response of First and Second Order System, Time Domain- Specifications - Generalized Error Series - Steady State Error - Static and Dynamic Error Constants.

UNIT 3 STABILITY OF CONTROL SYSTEM

12 Hrs.

Characteristics Equation - Location of Roots in S Plane for Stability - Routh Hurwitz Criterion - Root Locus Analysis - Effect of Pole Zero Additions on Root Locus - Nyquist Stability Criterion.

UNIT 4 FREQUENCY RESPONSE ANALYSIS

12 Hrs.

Frequency Response of the System - Correlation between Time and Frequency Response - Gain and Phase Margin - Bode Plot - Nyquist Plot (Polar Plot).

UNIT 5 COMPENSATION AND CONTROLLERS

12 Hrs.

Introduction to compensation networks - Lag, Lead and Lag Lead networks - Effect of providing Lag, Lead and Lag-Lead compensation on system performance and design using bode plot - P, PI, PID Controllers design.

Max. 60 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Determine the transfer function for a electromechanical system
- CO2 - Analyze the response of any linear time invariant system
- CO3 - Examine the stability of a system using root locus, Routh Hurwitz criterion .
- CO4 - Analyze the frequency response for linear time invariant system using bode plot
- CO5 - Design a P,PI,PID controller in real world problem.
- CO6 - Design a Lag, Lead, Lag-Lead compensator network for real world problem

TEXT / REFERENCE BOOKS

1. I.J.Nagarath and M.Gopal, "Control System Engineering" New Age International (p) Limited Publishers, 2nd edition, 2009.
2. Kausuhio Ogata, "Modern Control Engineering", Prentice Hall of India PVT. Ltd, 5th edition.
3. Richard Dorf, "Modern Control Systems", Pearson Education Ltd, 11th Edition 2009.
4. M.N. Bandyopadhyay, "Control Engineering, Theory and Practice" PHI, 4th print, 2006.
5. N.K.Sinha, "Control Systems", New Age International Private Limited Publishers, 3rd Edition, 1998, reprint 2004.
6. A.Nagoorkani, "Control System", RBA Publications, 3rd edition, reprint 2012.
7. U.A.Bakshi and S.C.Goyal, "Control System Engineering", Technical Publication, 2nd Revised reprint 2007.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks: 80

Exam Duration: 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B: 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SEC1321	TELECOMMUNICATION SYSTEMS AND SERVICES (For ECE and ETCE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 BASICS OF TELECOMMUNICATION**9 hrs**

End users, nodes and connectivities, telephone numbering and Routing, use of Tandem switches in Local area connectivity, Busy Hour and Grade of Service, Simple, Half duplex and full duplex, One-way and two-way circuits, Network topologies, variations in traffic flow, quality of service, Standardization in telecommunication.

UNIT 2 SIGNALLING IN TELECOMMUNICATION SYSTEMS**9 hrs**

Introduction, purpose of signaling, Defining the functional areas-supervisory signaling, address signaling and Call Progress-audio and visual. Signaling techniques - conveying signaling information, evolution of signaling subscriber call progress tones and push button codes, compelled signaling, concepts of Link-by-link and end-to-end signaling, effects of numbering on signaling, associated and disassociated channel signaling, signaling in the subscriber loop-background and purpose, metallic trunk signaling - basic loop signaling, reverse-battery signaling, stimulus signaling, functional signaling, Object-oriented signaling.

UNIT 3 TELECOMMUNICATION TRAFFIC**9 hrs**

Unit of Traffic, traffic measurement, a mathematical model, Lost- call systems: Theory, traffic performance, loss systems in tandem. Queuing systems - Erlang Distribution, probability of delay, Finite queue capacity, systems with a single server, Queues in tandem, delay tables and application of Delay formulae. Traffic Characteristics - arrival distributions, Holding time distribution. Loss Systems - Lost calls cleared, lost calls returning, lost calls Held, lost calls cleared. Overflow Traffic.

UNIT 4 TELECOMMUNICATION SERVICES ENGINEERING**9 hrs**

Introduction, Definition For Service And Service Engineering. Telecommunication Services Engineering- **Telecommunication Services On Broad Band Networks** - Basics of ATM, Connection Oriented And Connectionless Services.

UNIT 5 QUALITY OF SERVICE AND TELECOMMUNICATION IMPAIRMENTS**9 hrs**

QoS (voice, data and image) - signal-to-noise ratio, voice transmission, data circuits, video. Basic impairments - amplitude distortion, phase distortion and noise. Level - typical levels, echo and singing. **QoS issues in video transmission - problems and solutions. Protocols for QoS support for audio and video applications - RSVP applications, Real-Time Streaming Protocol Applications and Active Streaming Format, Internet stream protocol (version 2), IP Multicast**

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the various types of connectivity, topology and standardization in telecommunication
CO2	Explain the types of signaling
CO3	Demonstrate the traffic and delay performance
CO4	Analyze the various services of communication under critical conditions
CO5	Evaluate data transmission impairment techniques in telecommunications
CO6	Examine various protocols for data transmission

TEXT / REFERENCE BOOKS:

1. Roger L. Freeman, "Fundamentals of Telecommunications", John Wiley & Sons, 2008.
2. Kornel Terplan, Patricia Morreale Boca Raton, "The Telecommunications Handbook", CRC Press LLC, 2000.
3. Flood. J.E., Telecommunication switching, Traffic and Networks, Pearson Education Ltd, New Delhi, 2006
4. Viswanathan T, Telecommunication switching systems and networks, PHI 2006
5. Marin Cole, "Introduction to Telecommunications –Voice, Data and Internet", Pearson Education, 2001
6. Louis.E.Frenzel, Communication Electronics – Principles and Application", 3rd Edition, Tata McGraw-Hill, 2002

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1201	MICROPROCESSORS AND MICROCONTROLLERS (For ECE, ETCE, E&C, CSE and IT)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION TO MICROPROCESSORS**9 hrs**

Introduction, 8085 Architecture, Pin Diagram and signals, Addressing Modes, Timing Diagram- Memory read, Memory write, I/O cycle, Interrupts and its types, Introduction to 8086 microprocessors and its operation.

UNIT 2 PROGRAMMING 8085 MICROPROCESSOR**9 hrs**

8085 assembly language programming, addressing modes, 8085 instruction set, Instruction formats, Instruction Classification: data transfer, arithmetic operations, logical operations, branching operations, machine control —Stack and subroutines, Example Programs

UNIT 3 PERIPHERALS AND INTERFACING**9 hrs**

Introduction, memory and I/O interfacing, data transfer schemes, Interface ICs'- USART (8251), programmable peripheral interface (8255), programmable interrupt controller (8259), programmable counter/interval timer (8254), Analog to Digital Converter (ADC), and Digital to Analog Converter (DAC).

UNIT 4 INTRODUCTION TO MICROCONTROLLERS**9 hrs**

Introduction To Microcontrollers, Difference Between Microprocessors And Microcontrollers, Architectural Features of 8051, I/O Ports, Interrupts, Addressing Modes And Instruction Set Of 8051, Programming Examples.

UNIT 5 APPLICATIONS BASED ON 8085 AND 8051**9 hrs**

Interfacing Basic Concepts, Interfacing LED, 7 Segment LED, Stepper Motor Control System, Temperature Control System, Traffic Light Control System, Motor Speed Control System, Waveform Generation, Interfacing LCD.

Max. 45 hrs**COURSE OUTCOMES:**

On completion of this course, students are able to

CO1	Describe the fundamentals of 8085 and 8086
CO2	Apply addressing mode and instruction set to program 8085 microprocessor
CO3	Develop the interfacing concepts of Peripheral IC's
CO4	Create assembly language programs using 8051 microcontroller
CO5	Examine the applications of microprocessor and microcontroller
CO6	Design and develop microprocessor and microcontroller based systems

TEXT / REFERENCE BOOKS:

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming and applications with 8085", 5th Edition, Penram International Publishing Pvt Ltd, 2010
2. Kenneth J Ayala, "The 8051 Microcontroller", 2nd Edition, Thomson, 2005
3. N.Senthil Kumar, M.Saravanan, S.Jeevananthan, 'Microprocessors and Microcontrollers', Oxford,2013
4. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1316	CMOS VLSI DESIGN (For ECE, EEE, E&C, EIE and ETCE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 MOS TRANSISTOR THEORY**9 hrs**

The MOS transistor-Current Voltage Relations-Threshold Voltage-Second order effects-Capacitances in MOSFET - Scaling of MOS circuits -Review of CMOS - DC characteristics - Dynamic behavior- Power consumption

UNIT 2 COMBINATIONAL LOGIC DESIGN**9 hrs**

nMOS depletion load and Static CMOS design - Determination of Pull-up and Pull-down ratio-Design of Logic gates- Sizing of transistors -Stick diagrams-Lay out diagram for static CMOS - Pass transistor logic - Dynamic CMOS design - Noise considerations - Domino logic, np CMOS logic - Power consumption in CMOS gates - Multiplexers - Transmission gates design

UNIT 3 SEQUENTIAL LOGIC DESIGN**9 hrs**

Introduction - Static sequential circuits- CMOS static flip-flop - Dynamic sequential circuits -Pseudo static latch- Dynamic two phase flip-flop - clocked CMOS logic - Pipelining - NORA CMOS logic -True single-phase clocked logic - Realization of D-FF in TSPC logic

UNIT 4 SUBSYSTEM DESIGN**9 hrs**

Introduction-Designing Static and Dynamic Adder circuits - The Array Multiplier - Multiplier structures-Baugh-Wooly - Booth Multiplier - Barrel shifter - Memory structures - SRAM and DRAM design - Design approach of Programmable logic devices - PLA,PAL and FPGA

UNIT 5 ASIC CONSTRUCTION**9 hrs**

Physical design - Goals and Objectives - Partitioning methods - Kernighan Lin algorithm - Hierarchical Floor planning - Floor planning tools -input, output and power planning -Min-cut placement, Force directed placement algorithm - Placement using simulated annealing - Greedy channel routing

Max. 45 hrs**COURSE OUTCOMES:**

On completion of this course, students are able to

CO1	Describe the mathematical methods and circuit analysis models in analysis of CMOS transistors and inverters
CO2	Analyze the different styles of CMOS logic for design of combinational logic circuits
CO3	Design the static and dynamic sequential logic circuits
CO4	Evaluate the design of CMOS subsystems and memory structures
CO5	Explain the design of programmable logic devices
CO6	Construct a digital system using VLSI physical design flow

TEXT / REFERENCE BOOKS:

1. Jan M.Rabaey, "Digital Integrated Circuits", 2nd edition, September, Prentice Hall of India Ltd., 2003
2. M.J.S.Smith, "Application Specific Integrated Circuits", Pearson Education, 2006
3. Douglas A. Pucknell, "Basic VLSI design", 3rd edition, PHI Limited, 2007
4. Neil Weste, "Principles of CMOS VLSI design", Addison Wesley, 2000
5. Wayne Wolf, "Modern VLSI design '2nd Edition, Pearson education. 2003
6. Sung-Mo Kang & Yusuf, "CMOS Digital Integrated Circuits- Analysis & Design", 2nd Edition, Mc Graw Hill, 2003

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1320	EMBEDDED SYSTEMS (For ECE, ETCE, , E&C, CSE and IT)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION TO EMBEDDED SYSTEM**8 hrs**

Embedded system- characteristics of embedded system- categories of embedded system- requirements of embedded systems- challenges and design issues of embedded system- trends in embedded system- system integration- hardware and software partition- applications of embedded system- control system and industrial automation-biomedical-data communication system-network information appliances- IVR systems- GPS systems

UNIT 2 EMBEDDED SOFTWARE DEVELOPMENT AND TOOLS**8 hrs**

Software architectures, Round - Robin, Round-Robin with Interrupts, Function Queue Scheduling architecture, Introduction to assembler - Compiler -Cross compilers and Integrated Development Environment IDE, Linker/ Locators, Simulators, Getting Embedded software into target System- Debugging Strategies

UNIT 3 EMBEDDED NETWORKING**9 hrs**

Embedded Networking: Introduction, I/O Device Ports - Serial Bus communication protocols- RS232 standard - RS485 - CAN Bus - RS485 - Serial Peripheral Interface (SPI) - Inter-Integrated Circuits (I²C) - PC Parallel port communication Protocols -Bluetooth-network using ISA, PCI- Wireless and Mobile System Protocols.

UNIT 4 EMBEDDED PROGRAMMING**10 hrs**

Programming in assembly language (ALP) vs. High Level Language - C Program Elements:- Macros and functions, Use of Date Types, Structure, Pointers, Function Calls - Concepts of Embedded Programming in C++- Objected Oriented Programming, Embedded Programming in C++, 'C' Program compilers - Cross compiler - Optimization of memory needs-Java programming advantages, disadvantages and J2ME concept

UNIT 5 EMBEDDED SYSTEM TESTING AND APPLICATION**10 hrs**

Introduction to embedded system testing - Types of testing: Unit testing, Regression testing, Functional testing, Coverage tests, Gray box test and performance testing - Embedded applications: Case study of Smart card, Interfacing stepper motor, RFID-system, Application, Tag Reader - Handheld Device - Washing Machine

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the basics principles of Embedded system and its application
CO2	Describe development tools used to design embedded systems
CO3	Compare the performance of various communication protocols for embedded systems
CO4	Analyze the various programming strategies in embedded system
CO5	Apply the programming concepts of C,C++,J2ME
CO6	Estimate the performance of Embedded system using various testing methodologies

TEXT / REFERENCE BOOKS:

1. Raj Kamal, 'Embedded system-Architecture, Programming, Design', Tata McGraw Hill,2011
2. KVKK Prasad, "Embedded / Real Time Systems", Dreamtech Press, 2005
3. David Simon, "An Embedded Software Primer", Pearson Education Asia, First Indian Reprint 2000
4. Arnold Berger, "Embedded system design", CMP books, 1st Edition, 2005
5. Wayne Wolf, "Computers as components", Morgan Kaufmann publishers, 2nd Edition, 2008
6. Tammy Noergaard, "Embedded Systems Architecture", Elsevier, 2006
7. Steve Heath, "Embedded Systems Design", Second Edition, Elsevier India Pvt.Ltd., 2007
8. Ayla, "Embedded System", Pearson Education,2nd Edition 2013
9. Qing Li, "Real Time Concepts for Embedded Systems",Elsevier,2011

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SEC1618	PROGRAMMING IN MATLAB	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION

9 hrs

Menus & Tool bars, Variables – Matrices and Vectors- initializing vectors- data types- Functions –user defined functions-passing arguments-writing data to a file-reading data from a file- using functions with vectors and matrices- cell arrays & structures -Strings -2D strings-String comparing- Concatenation – Input and Output statements - Script files

UNIT 2 LOOPS & CONTROL STATEMENTS

9 hrs

Introduction; Relational & Logical operations –Example programs-Operator precedence – Control & Decision statements- IF – IF ELSE - NESTED IF ELSE - SWITCH- TRY & CATCH - FOR –WHILE – NESTED FOR- FOR with IF statements, MATLAB program organization, Debugging methods - Error trapping using eval & lastern commands

UNIT 3 PLOTS IN MATLAB & GUI

9 hrs

Basic 2D plots, Labels, Line style, Markers, plot, subplot, LOG, LOG-LOG,SEMILOG-POLAR-COMET, Grid axis, , labeling, fplot, ezplot, ezpolar, polyval, exporting figures, HOLD, STEM, BAR, HIST, Interactive plotting, Basic Fitting Interface- Polyfit- 3D plots- Mesh- Contour –Example programs. GUI- Creation Fundamentals- Capturing mouse actions

UNIT 4 MISCELLANEOUS TOPICS

9 hrs

File & Directory management - Native Data Files-data import & Export – Low Level File I/O – Directory management – FTP File Operations – Time Computations -Date & Time – Format Conversions – Date & Time Functions – Plot labels – Optimization – zero Finding – Minimization in one Dimension - Minimization in Higher Dimensions- Practical Issues. Differentiation & Integration using MATLAB, 1D & 2D Data Interpolation

UNIT 5 SIMULINK & APPLICATIONS

9 hrs

How to create & run Simulink, Simulink Designing- Using SIMULINK Generating an AM signal & 2nd order systems- Designing of FWR & HWR using Simulink-Creating a subsystem in Simulink. Applications Programs- Frequency response of FIR & IIR filters. Open Loop gain of OPAMP, I/P characteristics of BJT, Plotting the graph between Breakdown voltage & Doping Concentration. PCM ,DPCM

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Describe the representation of matrices, vectors and strings in MATLAB, operations in files
CO2	Develop MATLAB programs using looping and control statements
CO3	Develop 2D and 3D plots, Graphical User Interface for a given problem
CO4	Develop file management system using MATLAB
CO5	Design Simulink for electronic circuits and communication systems
CO6	Develop MATLAB programming for real time applications

TEXT / REFERENCE BOOKS:

1. Rudra Pratap, "Getting Started with MATLAB 6.0", 1st Edition, Oxford University Press, 2004
2. Duane Hanselman, Bruce Littlefield, "Mastering MATLAB 7", Pearson Education Inc, 2005
3. William J.Palm, "Introduction to MATLAB 6.0 for Engineers", Mc Graw Hill & Co, 2001
4. M.Herniter, "Programming in MATLAB", Thomson Learning, 2001
5. K.K.Sharma, "MATLAB Demystified", K.K.Sharma, Matlab : Demystified Basic Concepts and Applications, Vikas Publishing House Pvt Ltd, 2010
6. Stephen J. Chapman, "MATLAB Programming for engineers", Thomson, 4th Edition, 2007

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SEC 4067	MICROPROCESSORS AND MICROCONTROLLERS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:**MICROPROCESSOR- 8085**

1. Programs using Arithmetic operations.
2. Programs for Code conversions.
3. Largest, smallest, and sorting of an array.

MICROCONTROLLER- 8051

4. Data Transfer Programs.
5. Programs Using Logical Instructions.
6. Programs using Bit manipulation Instructions.
7. Reading and Writing on Parallel port.
8. Stepper Motor controller.
9. Timer Operations.
10. Serial communication Implementation.

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Describe the Mnemonics in ALP
CO2	Relate the problem statement with mathematical equations
CO3	Develop the suitable algorithm / Pseudo code
CO4	Analyze the proposed algorithm / Pseudo code
CO5	Evaluate the algorithm by providing test cases
CO6	Develop an ALP for the specified problem

SEC4063	COMMUNICATION ENGINEERING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:

1. Amplitude modulation & determine its modulation factor
2. Amplitude demodulation by linear diode detector
3. Frequency modulation and determine its modulation factor
4. Ratio detector as FM Demodulator
5. Pulse amplitude modulator using IC 555
6. Sampling and reconstruction of Pulse Amplitude modulation system
7. Delta modulation and demodulation technique
8. Pulse Duration Modulation using IC 555
9. Generation of Amplitude Shift Keying
10. Phase Shift keying modulation and demodulation
11. Frequency Shift keying modulation and demodulation
12. Frequency Division Multiplexing
13. Balanced modulator circuit using MC1496
14. Frequency response characteristics of IF amplifier
15. Construction and testing of a mixer stage
16. Pre-emphasis & De-emphasis

COURSE OUTCOMES:

At the end of the course, student will be able to

CO1	Describe the working of active/passive electronic devices / ICs
CO2	Describe the basics of analog and digital communication
CO3	Apply the theoretical communication concepts in developing schematic circuit diagram
CO4	Analyze the circuit for various input parameters
CO5	Evaluate the performance of the circuit
CO6	Develop the circuit for desired requirement

SEC1402	PROGRAMMING IN HDL (For ECE and EEE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 BASIC CONCEPTS IN VHDL**9 hrs**

Digital system design process - Hardware simulation - Introduction to VHDL - Language elements of VHDL - Data objects - Data types - Operators - Signal assignments - Inertial delay mechanism - Transport delay mechanism - Variable assignments - Concurrent and Sequential assignments- Delta delay.

UNIT2 MODELING IN VHDL**9 hrs**

Data flow modeling - Concurrent Signal Assignment statements - **Structural modeling** - Component declaration - Component Instantiation - **Behavioral modeling** - Process statement - wait statement - Conditional and loop statements -Generics and configurations - Examples for modeling.

UNIT3 INTRODUCTION TO VERILOG HDL**9 hrs**

Basic concepts - Levels for design description - Module - Delays - Language elements - Compiler directives - value set - data types - Parameters - Expressions - Operands - operators in Verilog HDL.

UNIT4 STYLES OF MODELING**9 hrs**

Gate level modeling -Primitive Gates- Multiple input and multiple output gates - User Defined Primitives - Combination UDP - Sequential UDP- Data flow modeling - Behavioral modeling - procedural constructs - procedural assignments - conditional and loop statements - Structural Modeling - Examples for modeling.

UNIT5 FEATURES IN VERILOG HDL**9 hrs**

Tasks- Functions -systems tasks and functions - Verification - **Modeling a test bench - timing and delays** - Switch level modeling - state machine modeling - Moore FSM – Melay FSM - Design of memories - Design of microcontroller CPUs.

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Identify the use of HDL language in constructing digital logic circuits
CO2	Analyze the combinational sequential logic circuit in gate and switch level modeling
CO3	Conceptualize the system through design and modeling various architectures
CO4	Develop any design based upon the system requirements for solving real time problems
CO5	Validate and Verify the system design
CO6	Design a test bench for any logic circuit

TEXT / REFERENCE BOOKS:

1. J.Bhaskar, "A VHDL Primer", Pearson. 3rd edition, 2013
2. Douglas L. Perry, "VHDL Programming by Example", McGraw Hill, 4th edition, 2012
3. J.Bhaskar, "A Verilog HDL Primer", Star Galaxy Publishing. 3rd edition, 2011
4. Stephen Brown, "Fundamental of Digital logic with VHDL Design", Tata McGraw Hill, 3rd edition, 2012

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1403	OPTICAL COMMUNICATIONS (For ECE and ETCE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 INTRODUCTION TO OPTICAL FIBERS**9 hrs**

Basics of optical communication system, light propagation in optical fibers, Optical spectral bands, Advantages of optical fiber communication over other communication systems, Ray theory and mode theory. Total internal reflection, Acceptance angle, Numerical aperture, phase and group velocity, cutoff wavelength and group delay. Different types of optical fibers, refractive index profiles & mode transmission

UNIT2 TRANSMISSION CHARACTERISTICS AND OPTICAL AMPLIFIER**9 hrs**

Characteristics of optical fibers: Attenuation due to absorption, scattering & bending, core and cladding losses, Signal Distortion in optical fibers: Intra modal Dispersion: Material & Waveguide dispersion; Intermodal dispersion: MMSI, MMGI & modal noise

Optical Amplifiers: Basic concepts, Erbium-Doped Fiber Amplifier, Raman amplifier -principles of operation, amplifier noise, signal to noise ratio, gain, gain bandwidth, intermodulation effects and wavelength range of operation

UNIT3 OPTICAL TRANSMITTERS AND RECEIVERS**9 hrs**

Fiber optic Transmitter module, Optical sources- LEDs, LASER diodes- Principles of operation: concepts of line width, phase noise. Optical detectors- PN, P-I-N, Avalanche photodiodes: Principles of operation: concepts of responsivity, sensitivity and quantum efficiency, noise in detection. Fiber optic receiver module

UNIT4 COUPLERS, CONNECTORS AND OPTICAL LINK**9 hrs**

Couplers: 2x2 coupler, Tap coupler, star coupler, Connectors: Cylindrical ferrule, Biconical Ferrule, Double eccentric, Splices: Fusion splices, Mechanical splices, Multiple splices. Design considerations in optical links, Point to point Links: Link Power budget, Rise Time budget, Analog Links: CNR, Multichannel transmission techniques-Multichannel Frequency Modulation, Subcarrier multiplexing. WDM Concepts and Components

UNIT5 OPTICAL NETWORKING PRINCIPLES AND APPLICATIONS**9 hrs**

FDDI, WDM, SONET/SDH, ATM, IP over WDM, Optical LAN Standards-IEEE802.3, Broad band and select WDM networks, Applications- Military

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Illustrate the basics of optical fiber cables
CO2	Describe the attenuation and dispersion characteristics in optical systems and comprehend the types of optical amplifiers
CO3	Distinguish the sources and detectors for real-time applications
CO4	Design optical communication system based on link budget
CO5	Evaluate the capacity of the systems using different networking techniques
CO6	Develop fiber distributed services for military application

TEXT / REFERENCE BOOKS:

1. Gerd Kaiser, "Optical Fiber Communications", 4th edition, Sixth reprint, Tata McGraw Hill, New Delhi, 2009
2. John M. Senior, "Optical Fiber Communications- Principles And Practice", Third Edition, Pearson Education, 2010
3. Gerd Keiser, "Optical communications Essentials", Tata Mc Graw Hill, Special Indian Edition, 2009
4. Govind P Agrawal, "Fiber-Optic Communication Systems", John Wiley & Sons, Third Edition, 2011
5. Ivan P. Kaminow, Casimer DeCusatis, "The Optical Communications Reference", Academic Press, 1st edition, 2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC4074	MICROWAVE AND OPTICAL LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:**MICROWAVE EXPERIMENTS**

1. Reflex klystron characteristics
2. Gunn diode characteristics
3. Measurement of VSWR and impedance of unknown load
4. Characteristics of Isolators and Circulators
5. Study of power distribution in directional couplers and waveguide tees
6. Radiation pattern measurement of microwave antennas
7. S-parameter measurement of micro strip components

OPTICAL FIBER EXPERIMENTS

1. DC Characteristics of optical sources and optical detectors
2. Measurement of Numerical Aperture of optical fiber cable
4. Measurement of Attenuation and Bending losses in optical fiber cable
4. Analog communication using Fiber optic cable
5. Digital Communication using optical fiber cable
6. PWM and PPM signal transmission using OFC

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the characteristics of microwave and optical devices
CO2	Select the appropriate device for the given communication requirements
CO3	Apply and demonstrate the working principle of microwave and optical devices
CO4	Analyze the different losses in microwave and optical system
CO5	Evaluate the power measurements for various microwave and optical systems
CO6	Construct the bench setup and verify the performance of various microwave and optical devices

SEC4072	HARDWARE DESCRIPTION LANGUAGE LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:

- 1 Logic gates
- 2 Adders and Subtractors
- 3 Multiplexer and Demultiplexer
- 4 Code Converters
- 5 Flip Flops
- 6 Shift registers
- 7 Synchronous Counters
- 8 Asynchronous Counters
- 9 Moore and Mealy FSM
- 10 Arithmetic Logic Unit

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the language elements of HDL
CO2	Demonstrate the logic function of the circuit
CO3	Construct the logic diagram
CO4	Develop the HDL program for the logic circuit
CO5	Evaluate the logical functionality through simulation
CO6	Create netlist of the logic circuits

SEC1405	RF AND MICROWAVE ENGINEERING (For ECE and ETCE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 MICROWAVE NETWORKS AND COMPONENTS

9 hrs

Introduction to microwaves and applications, advantages of microwaves, EM spectrum domain, Review of Low frequency parameters, salient features of S-matrix, salient features of multiport network, losses in microwave circuits, Waveguide corners, bends and twists. Isolator, Circulator- S-matrix of series element in the transmission line, S-matrix for E-plane Tee junction, S-matrix for H-plane Tee junction, S-matrix for magic Tee junction, S-matrix for directional coupler, Strip lines, Micro strip lines and coplanar waveguides

UNIT 2 POWER DIVIDERS AND COUPLERS

9 hrs

Basic properties of dividers and couplers: three port networks, four port networks, The T junction power divider: lossless divider, resistive divider, Wilkinson power divider: unequal power division and n- way Wilkinson power dividers, Quadrature hybrid (90°) coupler, Lange couplers, 180° Hybrid coupler, Even and odd mode analysis of the Wilkinson power divider, the quadrature hybrid, and ring hybrid, Filters design by image parameter and insertion loss method

UNIT3 MICROWAVE SOURCES

9 hrs

MICROWAVE TUBES: Klystron, Reflex Klystron, Magnetron - schematic, Principle of operation, performance, characteristics and application

MICROWAVE SOLID STATE DEVICES: PIN, Tunnel, Gunn, IMPATT and TRAPATT diodes, their construction and Principle of operation

UNIT4 MICROWAVE MEASUREMENTS

9 hrs

Microwave Bench general measurement set up, Measurement Devices and instrumentation: Slotted line, VSWR meter, power meter, spectrum analyzer, Network analyzer, Measurement of frequency, impedance, Attenuation, power and dielectric constant, measurement of VSWR, insertion loss, EMI / EMC basics and measurement methods.

UNIT5 MICROWAVE AND MILLIMETER WAVESYSTEMS

9 hrs

System aspects of antennas-microwave communication systems-the Friis power transmission formula-Microwave transmitters and receivers-noise characterization of microwave receiver-Frequency multiplexed systems-Radar systems-Millimeter-Wave Radios in Backhaul Networks-The 60 GHz, 70 GHz, 80 GHz, 90GHz frequency bands and channel sizes, The FCC and NTIA licensing process, Multi GBPS data communication and system requirements.

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Apply the knowledge of microwave frequencies and the waveguides
CO2	Analyze the operation and working of the various tubes or sources for the transmission of the microwave frequencies
CO3	Analyze the solutions for transmission line problems and impedance matching
CO4	Describe the differences between the conventional tubes and the microwave tubes for the transmission of the EM waves
CO5	Apply the knowledge of microwave measurement techniques to test and Evaluate performance of microwave components
CO6	Design and simulate waveguide components for various microwave applications

TEXT / REFERENCE BOOKS:

1. David M.Pozar "Microwave Engineering", John Wiley & Sons , 4 th Edition, 2013
2. Kulkarni M, "Microwave and Radar Engineering", Umesh Publication, 4th ed, 2010
3. Annapurna Das and Sisir K Das, "Microwave Engineering", TataMcGrawHill Inc., 2009
4. Reinhold Ludwig and Gene Bogdanov, " RF circuit Design: Theory and Applications", Pearson Education Inc., 2011
5. Inder J Bahl, " Fundamentals of RF and Microwave Transistor Amplifiers", John Wiley & sons Inc, 2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SBA1101	PRINCIPLES OF MANAGEMENT AND PROFESSIONAL ETHICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 MANAGEMENT FUNCTIONS & STRUCTURE

9 hrs

Management -Definition-Role of managers- **Levels of management**-Basic Function - Contribution of Taylor & Fayol. Types of structures - Line, staff, Functional, Committee and Project & Matrix - Structures. **Departmentalization - Centralization - Decentralization - Span of control. Management by Objectives (MBO)-** Management by Exception (MBE)

UNIT2 MANAGEMENT OF ORGINASATION

9 hrs

Forms of Business / Industrial Ownership - **Sole Trader, Partnership, Joint stock Company, Performance Appraisal -Basic Principles - Pitfalls - Methods to Overcome. Industrial Safety - Causes of Accidents - Cost of Accidents - Measures to avoid Accidents. Plant Layout & Maintenance -** Need, Types & Managerial Aspects

UNIT3 ORGANISATIONAL BEHAVIOUR

9 hrs

Organizational Behaviour - Definition - Nature & Scope - Contributing Disciplines - Importance of OB to Managers. Personality - Definition - Theories - **Factors Influencing Personality. Motivation** - Definition - Theories. Transactional Analysis. Morale & Job Satisfaction - Factors Influencing Job Satisfaction

UNIT4 GROUP DYNAMICS

9 hrs

Group - Definition - Types - Determinants of **Group Cohesiveness. Communication** - Process - Barriers - Effective Communication. Leadership-Definition- **leadership styles- Theories of leadership - Factors Contributing to Effective Leadership. Trade Unions-** Role of Trade Union in Organizations - Types and Functions of Trade Unions

UNIT5 PROFESSIONAL ETHICS

9 hrs

Ethics in Workplace - Formulation of Ethics - Managerial Ethics - Managing Ethical Behaviour - Codes of Ethics - Encouraging Ethical Behaviour - **Ethical Leadership - Ethical Decision making. Corporate Social Responsibility (CSR) - Intellectual Property Rights (IPR)-** Meaning- **Laws relating to Intellectual Property Rights (IPRs)**

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1	Acquire familiarity towards Evolution of Management, principles of F.W.Taylor's & Henry Fayol, Organizational structures and basics of management including concepts of MBO & MBE
CO2	Gain knowledge on the types of business organization, designing a layout for a plant, and the safety measure to overcome industrial accidents.
CO3	Recognize the importance of studying individual and group behavior at workplace and its effect on performance in organization
CO4	Develop expertise knowledge on the impact of Leadership Communication and Group dynamics in industry
CO5	Learn the basics of ethical behavior and corporate social responsibility practiced in industries
CO6	Solve cases business, to do a role play based on the knowledge gained from the subject and also apply the gained knowledge in industries in real life situations

TEXT / REFERENCE BOOKS:

1. Gupta C.B., "Management Theory and Practice", 14th Edition, Sultan Chand & Sons, 2009
2. Aswathappa, "Organizational Behaviour", 8th Edition, Himalaya Publishing House, 2010
3. Dr. Prasad L.M., "Organizational Behaviour", 4th Edition, Sultan Chand & Sons, 2011

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SEC1404	WIRELESS COMMUNICATIONS (Common to all Branches of B.E / B.Tech)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 TELEPHONE AND TELEVISION COMMUNICATION

9 hrs

History of wireless communication - Spectrum allocation for wireless communication - Standard bodies for wireless communication - Evolution of wireless communication starting from 1G to 5G - Cellular system concepts - Circuit switched and Packet switched cellular systems - architecture and operation of cellular systems – Frequency reuse - Channel Assignment(Fixed ,Dynamic, Hybrid).Flat fading and frequency selective fading – Diversity techniques (time, frequency, space) - PCS network architecture - Handoff - inter BS handoff-Inter system handoff - Hard handoff and soft handoff

UNIT 2 SATELLITE COMMUNICATION

9 hrs

Global System for Mobile communications (GSM) - Functional architecture of GSM - Common control channels - Dedicated control channels -Location tracking and call setup - GSM location update - Short Message Service (SMS) - Network architecture of SMS - Protocol hierarchy of SMS. Evolving from GSM to General Packet Radio Service (GPRS) - Functional groups of GPRS - Architecture of GPRS - Interfaces of GPRS

UNIT 3 RADAR COMMUNICATION

9 hrs

Wireless Application Protocol (WAP) - WAP model - WAP Gateway - WAP Protocols-Wireless Datagram protocol (WDP) - Wireless Transport layer security (WTLS)-Wireless Transaction protocol (WTP) - Wireless Session protocol (WSP) - Wireless Application Environment (WAE) - Wireless bearers for WAP. Functional Architecture, Protocol and technical details of - Bluetooth - ZigBee - Ultra Wide Band (UWB)-IrDA (Infra-red Data Association) - Radio Frequency Identification (RFID)

UNIT 4 WIRELESS COMMUNICATION

9 hrs

3G Networks - Features and Performance of 3G networks -Frequency allocation for IMT (International Telecommunications Union) 2000 - IMT 2000 family - Architecture of Universal Mobile Telecommunications System(UMTS) network - MAC layer-RLC layer-RRC layer - 3GPP release 99 network architecture. Network architecture of Enhanced Data rates for Global Evaluation EDGE).CDMA 2000 - Physical channels - Radio Interface parameters of CDMA 2000 FDD- Transmission characteristics of CDMA 2000 TDD

UNIT 5 EVOLUTION OF MOBILE TECHNOLOGIES

9 hrs

Features, operation and applications of Wi-Fi, WiMax, OFDM, OFDMA, OFDM-IDMA, MIMO, Cognitive Radio, LTE

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the overall cellular concepts
CO2	Describe the step by step evolution of 1G to 5G networks
CO3	Explain the 2G, 3G and B2G systems
CO4	Describe the functional Architecture and Protocol of Bluetooth, ZigBee and RFID
CO5	Explain the Functional architecture of GSM and GRPS
CO6	Implement the testing of Cognitive Radios

TEXT / REFERENCE BOOKS:

1. Andreas F. Molisch, "Wireless Communications", 2nd Edition, John Wiley & Sons Ltd, 2011
2. Theodore S Rappaport., "Wireless Communications Principles and Practice", Second edition, Pearson.2006
3. Simon S. Haykin, Michael Moher, "Communication Systems", Wiley, 5th edition, 2009
4. Tao Jiang, Lingyang Song and Van Zhang, "Orthogonal Frequency Division Multiple Access Fundamentals and Applications" Taylor and Francis Group, 2010
5. George Kennedy, Brendan Davis, S.R.M Prasanna, "Electronic Communication Systems", McGraw Hill Education, 5th edition, 2011

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SEC4062	ANALOG INTEGRATED CIRCUITS LAB (For ECE)	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:

- 1 Study of IC 741
- 2 Measurement of Op amp parameters
- 3 Inverting, Non Inverting amplifier, Integrator and Differentiator
- 4 Precision Rectifiers (HW & FW)
- 5 Filters (LPF & HPF)
- 6 A/D & D/Converters
- 7 RC Phase Shift Oscillator
- 8 Astable Multivibrator Using IC 741
- 9 Schmitt Trigger
- 10 PLL as voltage multiplier
- 11 Astable Multivibrator using IC 555
- 12 Comparators
- 13 Wein's Bridge Oscillator
- 14 Instrumentation Amplifier

COURSE OUTCOMES:

At the end of the course student will be able to

CO1	Interpret the function of various analog circuits
CO2	Describe the working of analog integrated circuits
CO3	Identify the appropriate methods for analyzing the characteristics of analog circuits
CO4	Analyze the input –output response of different types of analog circuits
CO5	Build the required analog circuit using OP-AMP and Timer ICs
CO6	Estimate the performance of built-in circuits

SEC4065	DIGITAL SIGNAL PROCESSING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:

1. Study of ADSP 21XX & TMS 320 C XX processor
2. Generation of Periodic Signals
3. Generation of Non Periodic Signals
4. Sampling
5. Modulation and Demodulation using Matlab
6. Computation of Z Transforms and Inverse Z transforms
7. Computation of Impulse & System Response
8. Design of FIR filters using Windowing Techniques
9. Design of IIR filters using Bilinear Transformation
10. Spectral Analysis using Matlab
11. Implementation of FFT using DIT and DIF algorithm
12. Convolution (Linear and Circular)
13. Correlation (Auto & Cross)
14. Frequency response of first and second order systems
15. Fast Fourier Transform (FFT), Inverse Fast Fourier Transform (IFFT)

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the fundamental concepts of Operators, Variables, Data types of Signals and Systems, I/O, Control and Loop statements in MATLAB
CO2	Relate the problem statement with mathematical concepts
CO3	Apply Signal processing concepts and write the pseudo code
CO4	Analyze the proposed algorithm / Pseudo code
CO5	Evaluate the algorithm by providing the test cases
CO6	Develop the MATLAB program for various signal processing applications

SEC1306	DATA COMMUNICATION AND NETWORKING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 DATA COMMUNICATION- BASICS

9 hrs

Digital data - digital signals - Bit rate - Bit length - Data rate limits - noise less channels - Noisy channel - Shannon capacity - Performance - Bandwidth - throughput - latency - Bandwidth delay product - jitters. Circuit switched networks - Datagram networks - virtual circuit networks - connection oriented and connection less services - Structure of circuit switches and packet switches - OSI reference model - TCP/IP reference model - comparison of both models.

UNIT 2 NETWORKING

9 hrs

Network Topologies - mesh, star, bus, and ring - hybrid topology - Network Standardization - De facto and De jure standards of networks - ITU - ISO - IETF - NIST - IEEE - Different IEEE802 working groups - internet-Architecture of the internet - Third generation mobile networks - UMTS Architecture - Wired Ethernet - Wireless LANs IEEE 802.11 - RFID - Different types - sensor networks - Multi hop topology of sensor networks.

UNIT 3 PHYSICAL LAYER AND DATALINK LAYER

9 hrs

The Physical layer - Media - Twisted pair - coaxial cable - microwave - infrared - millimetre wave - PSTN - The local loop modem - ADSL - Switching - Internet over cable - cable modems The Data link layer - design issues - Error detection and control - data link protocols - HDLC - PPP - IEEE standards for data link layer.

UNIT 4 MAC SUB LAYER AND NETWORK LAYER

9 hrs

MAC sub layer for Standard Ethernet, Fast Ethernet, Wireless LAN and broadband wireless Design issues of network layer - Routing algorithm - shortest path routing - Distance vector routing - Broadcast routing - Congestion control algorithm - Congestion control in virtual circuit and datagram switches - The network layer in the internet - The IP protocol - IP Addresses - Mobile IP - IPv6.

UNIT 5 TRANSPORT LAYER AND APPLICATION LAYER

9 hrs

The transport layer - service provided to the upper layer - Elements of transport protocols - Addressing - connection establishment - connection release - UDP - TCP TELNET - E mail - The user agent - Message transfer agent-SMTP - Message access agent: POP and IMAP - File Transfer Protocol - HTTP - SNMP - VOIP.

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the type of signals to detect and correct single, simple burst errors and switching concepts
CO2	Identify the types of multiplexing and LAN topologies
CO3	Explain the features and characteristics of ISDN & ATM
CO4	Analyze the importance of interconnecting devices and role of protocols in application layer
CO5	Describe the underlying working concepts of a real-time network
CO6	Implement the concept of data communication on application level networking

TEXT / REFERENCE BOOKS:

1. Behrouz A. Forouzan, "Data communication and Networking", Fourth Edition, Tata McGraw Hill Publications, 2011
2. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", Fifth Edition, Pearson Education, 2009
3. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010
4. Andrew.S.Tenenbaum, "Computer Networks", 5th Edition, Prentice Hall of India, 2011
5. Michael A.Gallo, William Hancock.M, Brooks/Cole Computer Communications and Networking Technologies,2001
6. Pallapa Venkataram and Sunilkumar S.Manvi, "Communication protocol Engineering", PHI Learning, 2008
7. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", Mc Graw Hill Publisher, 2011

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SIC1311	BIOMEDICAL INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 ELECTROPHYSIOLOGY**8 hrs**

Cell and Its Structure – Electrical, Mechanical and Chemical Activities – Action and Resting Potential- Organization of Nervous System – CNS – PNS – Neurons – Axons- Synapse – Propagation of Electrical Impulses along the Nerve- Sodium Pump – Cardio Pulmonary System- Physiology of Heart, Lung, Kidney

UNIT 2 BIO POTENTIAL ELECTRODES AND TRANSDUCERS**8 hrs**

Design of Medical Instruments – Components of Biomedical Instrument System – Electrodes: Micro Electrodes, Needle Electrodes, Surface Electrodes – Instrumentation amplifier - Biomedical Measurements like PH, PCO₂, PO₂ of Blood, Isolation Amplifier, Preamplifier, Current Amplifier, Chopper Amplifier

UNIT 3 INSTRUMENTS USED FOR DIAGNOSIS**10 hrs**

ECG, Einthoven Triangle, Leads, Electrodes, Vector Cardiograph, Measurement of Cardiac Output, EEG, EMG, Plethysmography, Blood Flow Measurements, Holter Monitor- Respiratory Rate Measurement – Oximeter, Patient Monitoring System, ICCU

UNIT 4 MODERN IMAGING SYSTEM**10 hrs**

Ultrasonic Diagnosis, Ultrasonic Scanning, Isotopes in Medical Diagnosis- Pace Makers, Defibrillators, Doppler Monitor(colour), Medical imaging-X-ray generation, Radiographic & Fluoroscopic Techniques – Image Intensifiers-Computer Aided Tomography, PET, SPECT- Laser Applications-Echocardiography-CT Scan-MRI/NMR- Endoscopy

UNIT 5 RECENT TRENDS & INSTRUMENTS FOR THERAPY**9 hrs**

Dialysers – Surgical Diathermy – Electro Anaesthetic and Surgical Techniques. Sources of Electric Hazards and Safety Techniques. Single Channel Telemetry, Multi channel Telemetry, Implantable Telemetry, Wireless Telemetry, Telemedicine, Telemedicine Applications

Max.45 Hrs**COURSE OUTCOMES:**

On completion of this course, students are able to

CO1	Recall the structure of cell, physiology of different biological systems and their functions
CO2	Interpret the types of electrodes and measurements of biological parameters
CO3	Analyze diagnostic instruments, therapeutic instruments and imaging systems

CO4	Compare and contrast suitable medical imaging equipments used for diagnostic purposes
CO5	Evaluate the working of modern therapeutic equipment's and telemedicine which would enable to create novel biomedical device
CO6	Design and develop novel therapeutic and diagnostic biomedical equipments

TEXT / REFERENCE BOOKS:

1. LeslieCromwell, FredJ. Werbell and Eruch A. Pfeigger, "Biomedical Instrumentation and Measurements" 2nd Edition, 2000.
2. Handbook of Biomedical Instrumentation by R. S. Khandpur, Tata McGraw Hill, 2003
3. M. Arumugam, "Biomedical Instrumentation", Anuradha Publications, Reprint 2009
4. J.G. Webster, "Medical Instrumentation Application and Design", John Wiley & Sons, 2010
5. R. Anandanatarajan, "Biomedical Instrumentation and Measurements", PHI Learning Pvt.Ltd- 2011

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 2 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1614	MOBILE COMMUNICATIONS (For ETCE and ECE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 WIRELESS COMMUNICATION

9 hrs

Basic cellular systems - Frequency Management and Channel Assignment - Types of handoff and their characteristics, dropped call rates & their evaluation - MAC - SDMA - FDMA - TDMA - CDMA - Cellular Wireless Networks

UNIT2 WIRELESS NETWORKS

9 hrs

Wireless LAN - IEEE 802.11 Standards - Architecture - OFDM Technology - Services - Mobile Ad hoc Networks- IEEE 802.16 standards, Comparison of 802.11 and 802.16 - Wireless Local Loop - Architecture - WLL Technologies

UNIT3 MOBILE COMMUNICATION SYSTEMS

9 hrs

GSM – Architecture - Location tracking and call setup - GSM Mobility management – Handover – Security - GSM SMS - International roaming for GSM - Call recording functions - subscriber and service data management - Mobile Number portability

GPRS – Architecture - GPRS procedures - Attach and detach procedures - PDP context procedure - Combined RA/LA update procedures - Billing

UNIT4 MOBILE NETWORK AND TRANSPORT LAYERS

9 hrs

Mobile IP - Dynamic Host Configuration Protocol - Mobile Ad Hoc Routing Protocols - Multicast routing - TCP over Wireless Networks - Indirect TCP - Snooping TCP - Mobile TCP - Fast Retransmit / Fast Recovery – Transmission / Timeout Freezing-Selective Retransmission - Transaction Oriented TCP - TCP over 2.5 / 3G wireless Networks

UNIT5 APPLICATION LAYER

9 hrs

WAP Model - Mobile Location based services - WAP Gateway - WAP protocols - WAP user agent profile-caching model - Wireless bearers for WAP - WML - WMLScripts - WTA – iMode - SyncML

Max: 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Comprehend the concepts of cellular mobile communication and various multiple access techniques
CO2	Apply wireless networks standards and its features
CO3	Analyze the protocol architecture of GSM and GPRS
CO4	Describe the different internetworking topologies in network and transport layer
CO5	Assess the knowledge on mobile applications based services
CO6	Develop skills in wireless application protocol and WML

TEXT / REFERENCE BOOKS:

1. Kaveh Pahlavan, Prasanth Krishnamoorthy, "Principles of Wireless Networks", First Edition, Pearson Education, 2003
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, New York, 2003
3. Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education, 2004
4. William Stallings, "Wireless Communications and Networks", Pearson Education, 2005
5. Yi-Bing Lin, Imrich Chlamtac, "Wireless and Mobile Network Architectures", John Wiley and sons, 2008

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SEC1609	FUNDAMENTALS OF FUZZY LOGIC AND ARTIFICIAL NEURAL NETWORKS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 FUNDAMENTALS OF ANN

9 hrs

Introduction - Biological Neuron structure, ANN - Definition – Topology - Models - Learning strategies. Characteristics of ANN - Different Learning Rules - Activation dynamics - Synaptic dynamics - Perceptron Model (Both Single & Multi Layer) - Training Algorithm - Linear Separability Limitation and Its Over Comings, Problems in Perceptron weight adjustments

UNIT 2 MULTI LAYER NETWORKS

9 hrs

BPN - Training - Architecture-Algorithm, Counter Propagation Network - Training - Architecture, BAM - Training-stability analysis, Adaptive Resonance Theory - ART1- ART2 – Architecture -Training, Hop Field Network - Energy Function - Discrete - Continuous - Algorithm - Application - TSP

UNIT 3 SOM & SPECIAL NETWORKS

9 hrs

SOM-Introduction - Kohonan SOM - Linear vector quantization, Probabilistic neural network, Cascade Correlation, General Regression neural network, Cognitron - Application of ANN - Texture classification - Character recognition

UNIT 4 INTRODUCTION TO FUZZY LOGIC

9 hrs

Classical set - Operations and properties - Fuzzy Set - Operations and properties - Problems, Classical Relations - Operations and Properties, Fuzzy Relations - Operations and Properties - Compositions Membership function -FLCS - Need for FLC- Fuzzification - Defuzzification

UNIT 5 FLCs, CLASSIFICATION & APPLICATIONS

9 hrs

Fuzzy decision making -Types, Fuzzy Rule Based System, Knowledge Based System, Non linear Fuzzy Control system - Fuzzy Classification - Hard C Means - Fuzzy C Means. Applications of fuzzy - Water level controller, Fuzzy image Classification, Speed control of motor

Max: 45 hrs

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Develop various topologies of artificial neural networks
CO2	Illustrate training and learning of neural systems using supervised and unsupervised methodologies
CO3	Demonstrate the usage of multi-layer and special networks for different case studies
CO4	Evaluate the behavior of Fuzzy logic control system
CO5	Explain the Defuzzification and fuzzy decision systems
CO6	Construct Fuzzy based controller for motor speed control, image processing etc.,

TEXT / REFERENCE BOOKS:

- 1 Timothy Ross, "Fuzzy Logic with Engineering Application", McGraw Hill, 2nd Edition, 2011.
2. James A. Freeman & Skapura, "Neural networks, algorithm, applications and programming technique.", Pearson Education, 2011
3. B.Yegnanarayana, "Artificial Neural Networks" Prentice Hall, September 2009
4. Simon Haykin, "Artificial Neural Networks", Second Edition, Pearson Education.1999
5. Drainkov, H.Hallendoor and M.Reinfrank, "An Introduction to Fuzzy Control", Edition 2004

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SIC1310	THEORY OF ROBOTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 BASIC CONCEPTS**9 hrs**

Origin & various generation of Robots - Robot definition - Robotics system components - Robot classification
 Coordinate frames - Asimov's laws of robotics - degree of freedom - dynamic stabilization of robots.- work volume. Need for
 Automation - types of automation - fixed, programmable and flexible automation

UNIT2 POWER SOURCES AND SENSORS**9 hrs**

Hydraulic, pneumatic and electric drives - determination of HP of motor and gearing ratio - variable speed
 arrangements - path determination - micro machines in robotics - machine vision - ranging - laser - acoustic - magnetic,
 fiber optic and tactile sensors

UNIT3 MANIPULATORS, ACTUATORS, GRIPPERS and ROBOT DYNAMICS**9 hrs**

Construction of manipulators - manipulator dynamics and force control - pneumatic electronic and manipulator control
 circuits - end effectors - various types of grippers- design considerations. Introduction to Robot Dynamics - Lagrange
 formulation - Newton Euler formulation - Properties of robot dynamic equations

UNIT4 KINEMATICS AND PATH PLANNING**9 hrs**

Forward Kinematics – Denavit Hartenberg Representation. Multiple solution Jacobian work envelopes, Inverse
 Kinematics - Geometric approach. Hill climbing techniques

UNIT5 PROGRAMMING LANGUAGES AND APPLICATIONS**9 hrs**

Robot programming - Fixed instruction, sequence control, General programming language, programming languages.
 Robots for welding, painting and assembly - Remote Controlled robots - robots in manufacturing and non- manufacturing
 applications - Robots for nuclear and chemical plants

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Apply the basic concepts for Robotic technology and selection of automation methods
CO2	Analyze different types of drives and sensors used in real world problems
CO3	Improve the various technology for sustainable built environment using manipulators, grippers and actuators
CO4	Evaluate different smart manufacturing technologies for industrial robotics based automation using Kinematic Techniques

CO5	Compare various advanced programming techniques for development of Robots
CO6	Build Robotic technology for Industry, Nuclear and Chemical Plants

TEXT / REFERENCE BOOKS:

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., "Industrial Robotics", McGraw-Hill Singapore, 1996
2. Ghosh, "Control in Robotics and Automation: Sensor Based Integration", Allied Publishers, Chennai, 1998
3. Deb.S.R. "Robotics technology and flexible Automation", John Wiley, USA 1992
4. Asfahl C.R., "Robots and Manufacturing Automation", John Wiley, USA 1992
5. Klafter R.D., Chimielewski T.A., Negin M., "Robotic Engineering - An integrated approach", Prentice Hall of India, New Delhi, 1994
6. McKerrow P.J. "Introduction to Robotics", Addison Wesley, USA, 1991.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 2 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SIT1606	BIG DATA	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION**9 Hrs.**

Introduction to Big Data - Challenges of Conventional Systems - Nature of Data - Small data - Medium data -BigData - Small data vs Big data - Sources of Big Data - Big Data Characteristics - Big Data Analytics - Importance of Big Data, Big Data in the Enterprise - Big Data Enterprise Model - Building a Big Data Platform - Big data in Social and Behavioral sciences.

UNIT 2 HDFS, HADOOP AND HADOOP INFRASTRUCTURE**9 Hrs.**

Hadoop and Databases - Typical Datacenter Architecture - Adding Hadoop to the Mix - Key Benefit - Flexibility:Complex Data Processing - HDFS - Hadoop Infrastructure - Architecture - Different in Data Model and Computing Model - HDFS Files and Blocks, Components of HDFS - Hadoop framework - HDFS - Map Reduce Framework - Data Loading techniques - Hadoop Cluster Architecture - Hadoop Configuration files - Hadoop Cluster modes - Single Node - Multi Node - Fully distributed node.

UNIT 3 HADOOP MAP REDUCE FRAMEWORK**9 Hrs.**

Relationship between MapReduce and HDFS - Relationship between MapReduce and HDFS - Clients, Data Nodes, and HDFS Storage - MapReduce workloads.Hadoop framework - Hadoop data types - Hadoop map reduce Paradigm - Map and Reduce Tasks - Map reduce Execution framework - Partitioners and Combiners - Input formats (Input Splits and Records, Text Input, Binary Input, Multiple Inputs)- Output Formats (TextOutput, BinaryOutPut, Multiple Output)- Hadoop Mapreduce programming - Advanced Map reduce concepts - Counters, Custom Writables - Unit testing framework - Error Handling - Tuning - Advanced Map reduce.

UNIT 4 HADOOP IMPLEMENTATION AND HADOOP ECO SYSTEM TOOLS**9 Hrs.**

Hadoop Implementation - Job Execution - Hadoop Data Types - Job Configurations - Input and Output Formats -ECO system tools - Pig's Data Model, Pig Latin, Developing & Testing Pig Latin Scripts - Writing Evaluation, Filter, Load & Store Functions - Hive - Hive Architecture - Comparison with Traditional Database - HiveQL: Data Types, Operators and Functions - Hive Tables - Querying Data - Advance Hive, NoSQL Databases - HBase - Loading Data in Hbase - Querying Data in Hbase

UNIT 5 HADOOP PROJECT ENVIRONMENT**9 Hrs.**

HBase: Introduction to HBase, Client API's and their features, Available Client, HBase Architecture, MapReduce - Integration. HBase: Advanced Usage, Schema Design, Advance Indexing, Coprocessors, Hadoop 2.0 -MRv2 - YARN - NameNode High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN, Upgrade your existing MRv1 code to MRv2, Programming in YARN framework-cover Apache Oozie Workflow Scheduler for Hadoop

Max. 45 Hours

COURSE OUTCOMES

On completion of the course, student will be able to–

1. Comprehend Enterprise Data to make Business Decisions
2. Analyse methods of loading voluminous data into Big Data framework using Flume and Sqoop.
3. Demonstrate the functions of Map Reduce Framework on any huge amount of Data
4. Apply Ecosystem tools for querying structured and unstructured Data.
5. Manage Data using HBase Framework.

6. Develop an application using Big Data tools.

TEXT / REFERENCES BOOKS

1. WA Gmob, "Big Data and Hadoop", Kindle Edition, 2013
2. Eric Miller, "A Overview of Map Reduce and its impact on Distributed Data", Kindle Edition, 2012.
3. Strata, " Big Data Now", O'Reily Media Inc., Kindle Edition, 2012.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration: 3 Hrs.**

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

80 Marks

SCS1619	PYTHON PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1**9 Hrs.**

Introduction to the IDLE interpreter (shell) -Expressions – Data Types - Built-in function -Conditional statements - Iterative statements- Input/output -Compound Data Types - Nested compound statements – Introduction to Object Oriented Concepts.

UNIT 2**9 Hrs.**

File Operations –Iterators - Exception handling - Regular Expressions

UNIT 3**9 Hrs.**

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts – Colours - Canvas - Widgets (frame, label, button, check box, entry, list box, message, radio button, text, spin box).

UNIT 4**9 Hrs.**

Database (using NoSQL): Connector Module –Cursor – Statements - Exceptions in database.
Network connectivity: Socket module - Client – Server – Email – URL Access

UNIT 5**9 Hrs.**

Web Programming using Python.

Image Processing – Facebook Analysis – Twitter Analysis.

Max. 45 Hrs.**COURSE OUTCOMES**

On completion of the course, student will be able to:

- CO1 : To learn and demonstrate the decision controls, looping constructs, lists and dictionaries in the design of Python Program.
- CO2 : To design and develop GUI based applications.
- CO3 : To deploy Web based applications by integrating with NoSQL Database.
- CO4 : To analyze the contents social media on Text mining, Sentiment Analysis.
- CO5 : To implement Machine Learning Algorithms (Cluster Algorithms, Decision Trees) using libraries.
- CO6 : To demonstrate visualization using open source data sets.

TEXT / REFERENCE BOOKS

- John Scott, "Social Network Analysis", Third Edition, SAGE Publications Ltd 2013.
 - Maksim Tsvetovat, Alexander Kouznetsov, "Social Network Analysis for Startups", First Edition, O'Reilly Media, 2011.
 - Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.
 - David Knoke, Song Yang, "Social Network Analysis", First Edition, SAGE Publication Ltd 2007.
 - Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.
 - Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking - Techniques and applications", First Edition Springer, 2011.
 - John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009
- Van.C.Warington, "Protective Relays-their Theory and Practice", Vol I & II, Champ Man and Hall Ltd, London, 2014.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration: 3 Hrs.****PART A:** 2 Questions from each unit, each carrying 2 marks

20 Marks

PARTB: 2 Questions from each unit with internal choice, each carrying 16 marks

80 Marks

SEC1101	ELECTRONIC DEVICES	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 SEMICONDUCTOR DIODES**9 hrs**

Intrinsic and Extrinsic semiconductor - Charge density, Mobility and Conductivity in Semiconductor, Drift and diffusion current, Continuity equation, PN junction - Energy band diagram of PN junction, Current components in PN junction, Junction capacitance - Application of diode - Diode switch, Clipper, Clamper and Voltage multipliers - Zener diode - Zener voltage regulators

UNIT 2 BIPOLAR JUNCTION TRANSISTOR**9 hrs**

Construction and Operation of NPN and PNP transistor - Current components in a transistor, Eber Moll's Equation- Characteristics of CE,CB,CC configuration - Base width modulation, Transistor breakdown, Transistor biasing - Bias Stabilization and Compensation, Thermal runaway problems, Heat sinks, Switching characteristics.

UNIT 3 FIELD EFFECT TRANSISTOR**9 hrs**

JFET- Construction, Operation and Characteristics, Expression for pinch off voltage and drain current – MOSFET Enhancement and Depletion mode operation and characteristics, Handling precautions of MOSFET, Gate capacitance - FET as VVR - Comparison of MOSFET and JFET - Comparison of BJT and JFET

UNIT 4 SPECIAL SEMICONDUCTOR DEVICES**9 hrs**

SCR- UJT- Diac - Triac - Schottky barrier diode- Varactor diode - PIN diode - Tunnel diode - Gunn diode - Laser diode- Operation, Characteristics and Applications

UNIT 5 PRINCIPLES OF CRT**9 hrs**

Force on charged particle in electric field and magnetic field - Motion of charged particle in electric and magnetic field - Oscilloscopes-Features and uses, Types and models- CRO, Dual beam oscilloscope, Analog Oscilloscope, Digital oscilloscope Principles of CRT - Deflection and focusing of electron beam in CRT -Orientation of electric and magnetic field in CRT - Applications of CRO

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Describe the voltage–current characteristics of semiconductor devices
CO2	Describe the functioning of various Bipolar Junction Transistors and its biasing
CO3	Compare the various characteristics of the Field Effect Transistors (like JFET,MOSFET)
CO4	Justify the characteristics of thyristor family devices, special diodes and its applications
CO5	Create knowledge in utilizing the latest type of oscilloscopes
CO6	Examine the theoretical concepts through laboratory experiments

TEXT / REFERENCE BOOKS:

1. Millman and Halkias, "Electronic devices and circuits", 2nd Edition, McGraw Hill Publication, 2007
2. David Bell, "Fundamentals of Electronic Devices and Circuits", 5th Edition, Oxford University Press 2008
3. Robert L. Boylestad, 'Electronic Devices and Circuits', Edition 4, Pearson Education India, 2009
4. B. Visweswara Rao, K. Bhaskararam Murthy, K. Raja Rajeswari, P. Chalam Raju Pantulu. "Electronic Devices and Circuits", Pearson Publications, 2nd Edition, 2009
5. S. Salaivahanan, N. Suresh Kumar, "Electronic Devices and Circuits", McGraw Hill Education India Pvt Ltd, 2013

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each - No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC4051	ELECTRONIC DEVICES LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:

1. Study of circuit components and equipments (Component identification, color coding, checking diode, BJT, FET, study of CRO, Audio Oscillator, Multimeter, LCR meter)
2. Characteristics of Semiconductor diode and Zener diode
3. Characteristics of CE and CB configuration
4. Characteristics of JFET
5. Characteristics of SCR & UJT
6. Characteristics of DIAC & LDR
7. Clippers and Clampers
8. Voltage Multipliers
9. Switching Characteristic of BJT
10. Characteristics of CC configuration

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the working and testing of Electronic Components, Measuring Instruments and Equipments
CO2	Describe the working and voltage – current characteristics of Bipolar and Unipolar devices
CO3	Identify the suitable procedure for analyzing the performance of Semiconductor devices
CO4	Analyze the V-I / I/O characteristics of Semiconductor devices
CO5	Justify the appropriateness of Semiconductor devices in the Circuit
CO6	Build electronic circuits with semiconductor devices and estimate the performance metrics

SEC1207	DIGITAL LOGIC CIRCUITS (For ECE, EEE, EIE, ETCE and E&C)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 BOOLEAN ALGEBRA AND LOGIC GATES**9 hrs**

Review of number systems - Binary arithmetic – Binary codes – Boolean algebra and theorems - Boolean functions –Minimization of Boolean functions-Sum of Products(SOP)-Product of Sums(POS)-Simplifications of Boolean functions using Karnaugh map and tabulation methods – Logic gates- NAND and NOR implementation

UNIT 2 DESIGN OF COMBINATIONAL CIRCUITS**9 hrs**

Introduction to Combinational circuits – Analysis and design procedures – Half Adder, Full Adder-Half Subtractor, Full Subtractor- Parallel binary Adder, Parallel binary Subtractor- Carry look ahead Adder- BCD Adder- Decoders- Encoders- Priority Encoder- Multiplexers- MUX as universal combinational modules- Demultiplexers- Code convertors- Magnitude Comparator

UNIT 3 DESIGN OF SEQUENTIAL CIRCUITS**9 hrs**

Introduction to Sequential circuits – Flip flops – SR, JK, D and T flip flops, Master Slave flip flops, Characteristic and excitation table – Realization of one flip flop with other flip flops – Registers – Shift registers – Counters – Synchronous and Asynchronous counters – Modulus counters, Up/Down counters – Ring Counter – Johnson Counter – State diagram, State table, State minimization – Hazards

UNIT 4 DIGITAL LOGIC FAMILIES**9 hrs**

Classification and characteristics of logic family – Bipolar logic family – Saturated logic family – RTL, DTL,DCTL, I²L,TTL, HTL – Non saturated family – Schottky TTL, ECL – Unipolar family – MOS, CMOS logic families. Tristate logic Interfacing of CMOS and TTL families. Comparison of logic families

UNIT 5 MEMORIES AND PROGRAMMABLE LOGIC DEVICES**9 hrs**

Classification of memories – ROM – ROM organization – PROM – EPROM – EEPROM – RAM – RAM organization – Write operation – Read operation – Memory decoding – Memory expansion – Static RAM – Dynamic RAM – Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL) – Field Programmable Gate Arrays (FPGA) – Implementation of combinational logic circuits using ROM, PLA, PAL

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the procedure of Number systems, binary codes , binary arithmetic, Boolean algebra and Logic gates
CO2	Apply the concepts of Combination circuits for their implementation
CO3	Design the various types of sequential logic circuits
CO4	Analyze the different types of Digital Logic families
CO5	Investigate the behavior and characteristics of digital logic families , PLDs
CO6	Create the structures of SRAM and DRAM

TEXT / REFERENCE BOOKS:

1. Milos Ercegovac, Jomas Lang, "Introduction to Digital Systems", Wiley publications, 1998
2. John M. Yarbrough, "Digital logic: Applications and Design", Thomas - Vikas Publishing House, 2002
3. R.P.Jain, "Modern digital Electronics",3rd Edition, TMH, 2003
4. Morris Mano, "Digital design", 3rd Edition, Prentice Hall of India, 2008
5. Floyd and Jain, " Digital fundamentals", 10th Edition 2009, Pearson Publishers
6. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEE1107	ELECTRICAL CIRCUITS AND NETWORKS	L	T	P	Credits	Total Marks
		3	1	0	4	100

UNIT 1 DC & AC CIRCUITS**12 hrs**

Electrical Quantities, Ohm's Law, Resistors - Series and parallel Combinations, Kirchhoff's Laws, Node and Mesh Analysis - Sinusoidal Functions - RMS(effective) and Average Values - Phasor Representation - J operator - Sinusoidal Excitation Applied to Purely Resistive - Inductive and Capacitive Circuits - RL - RC and RLC Series and Parallel Circuits

UNIT 2 NETWORK THEOREMS (BOTH AC & DC)**12 hrs**

Superposition Theorem - Reciprocity Theorem - Thevenin's Theorem - Norton's Theorem - Maximum power transfer Theorem

UNIT 3 NETWORK TOPOLOGY**12 hrs**

Network Topology - Basic concepts of Graph theory, Network Graph, Tree, Incidence & Reduced Incidence Matrices, Cut sets, Tie sets, Cut set schedule, Tie set schedule - Application to network solutions - Duality and Dual Networks

UNIT 4 NETWORK FUNCTION & ITS PARAMETERS**12 hrs**

Network Functions - Driving point Impedance - Transfer Functions- Network Parameters - Z, Y, h and ABCD Parameter Conversion Parameters of Important Networks - Lattice Network - T Network and π Network - Twin Network -Network Conversions - Bartlett's Bisection Theorem and its Application - Interconnection of Two Port Networks

UNIT 5 TRANSIENTS & RESONANT CIRCUITS**12 hrs**

Time Domain Analysis - Transient Response of RL, RC & RLC networks with DC Input and Sinusoidal AC Input Series and Parallel Resonance - Frequency Response - Quality Factor and Bandwidth

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Describe the various electrical quantities in different AC and DC circuits
CO2	Apply mathematical concepts to solve the electrical circuits for analyzing it
CO3	Deconstruct the complex circuits in to simple one using the electrical theorems
CO4	Analyze the electrical circuits in a graphical manner and solve it for the given task
CO5	Evaluate the two port networks of electrical circuits
CO6	Sketch the transient and steady state waveform of the electrical circuits

TEXT / REFERENCE BOOKS:

1. S.Sivanagaraju, G.Kishor & C.Srinivasa Rao, "Electrical Circuit Analysis", Cengage Learning, 1st Edition, 2010
2. W.H.Hayt, J.E.Kemmerly & S.M.Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, 8th Edition, 2012
3. Soni Gupta, "Electrical Circuit Analysis", Dhanbat Rai publications, 6th Edition, 1997 (Reprint 2007)
4. M.Arumugam & N.Premkumaran, "Electric Circuit Theory", Khanna Publications, 5th Edition, 2000 (Reprint 2012)

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SCS1102	FUNDAMENTALS OF PROGRAMMING (For ECE, EIE, E&C, ETCE, CSE and IT)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION**9 hrs**

Algorithms & flowcharts - Overview of C - Features of C - Structure of C program – Compilation & execution of C program - Identifiers, variables, expression, keywords, data types, constants, scope and life of variables, and local and global variables – Operators: arithmetic, logical, relational, conditional and bitwise operators– Special operators: size of () & comma (,) operator – Precedence and associativity of operators & Type conversion in expressions – Input and output statements

UNIT 2 CONTROL STRUCTURES AND FUNCTIONS**9 hrs**

Conditional statements – Looping statements – Functions: Library Functions – User Defined – Function Prototype - Function Definition – Types of Functions – Functions with and without Arguments Functions with no return and with Return Values - Nested Functions - Recursion

UNIT 3 ARRAYS AND STRINGS**9 hrs**

Arrays: Single and Multidimensional Arrays – Array Declaration and Initialization of Arrays – Array as Function Arguments.
 Strings: Declaration – Initialization and String Handling Functions
 Structure and Union: Definition and Declaration – Nested Structures – Array of Structures – Structure as Function Argument – Function that Returns Structure – Union

UNIT 4 STORAGE CLASSES AND POINTERS**9 hrs**

Storage Class Specifier: Auto, Extern, Static, & Register
 Pointers: The '&' and '*' Operators – Pointers Expressions – Arrays Using Pointers – Structures Using Pointers – Functions Using Pointer – Function as Arguments – Command Line Arguments

UNIT 5 MEMORY MANAGEMENT**9 hrs**

DMA functions: malloc (), calloc (), size of (), free() and realloc(). Preprocessor directives
 File management: File operations - opening & closing a file, input and output statements, Control statements

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Design the flowchart and algorithm for a given problem
CO2	Develop the C program using conditional statement and function
CO3	Construct the program for real time applications
CO4	Concept of pointers the while coding
CO5	Apply preprocessor directives for memory management
CO6	Create the programs using file concept for different applications

TEXT / REFERENCE BOOKS:

1. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011
2. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011
3. Subburaj. R, 'Programming in C', Vikas Publishing, First Edition, 2000

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC4055	CIRCUITS AND NETWORKS LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:

1. Verification of KCL & KVL
2. Verification of Thevenin's & Norton's Theorem
3. Series and Parallel Resonance
4. Constant K filters (both LPF & HPF)
5. M-Derived filters (both LPF & HPF)
6. Attenuators
7. Equalizers
8. Matching Networks
9. Twin T Network as Notch filter
10. Verification of reciprocity theorem
11. Verification of compensation theorem
12. Study of composite m-derived filters

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the basics of electrical components and theorems
CO2	Interpret the characteristics of various frequency selective devices
CO3	Design and Verify the characteristics of different passive circuits and networks
CO4	Analyze the performance of the designed circuit
CO5	Compare the experimental result with the theoretical value
CO6	Construct the suitable circuit for the desired application

SCS4101	PROGRAMMING IN C LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:**1. Understanding Looping Statements**

- (a) Implementation of Sine series
- (b) Generation of Fibonacci series
- (c) Reversing the digits of an integer
- (d) Understanding Pre Defined Function and User Defined Function

2. Conversion of decimal number to octal number**3. Conversion of character integer to decimal number****4. Finding the square root of a given number by applying algorithm****5. Understanding Conditional Statements**

- (a) Find GCD of two numbers
- (b) Generate Prime numbers between 1 and n

Understanding Array**6. Removal of duplicates from array and finding the maximum number in an array****7. Removal of duplicates from array and finding the minimum number in an array****Understanding Sorting Method****8. Sort by exchange, selection and partitioning method****Understanding Searching Techniques****9. Linear and binary search****Understanding Pointers****10. Pattern matching****Understanding File Handling Function****11. File operations**

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Illustrate the flowchart and design the algorithm for a given problem
CO2	Write programs for small applications
CO3	Develop programs using conditional statements
CO4	Understand the searching and sorting methods
CO5	Able to write programs using pointers
CO6	Develop application using file concept

TEXT / REFERENCE BOOKS:

1. Stephen Kochan, "Programming in C" (3rd edition), Sams Publishing 2009
2. Steve Oualline, "Practical C Programming" (3rd edition), O'Reilly Media 2011
3. David & Dawn Griffiths, "Head First C", O'Reilly Media 2012

SIC1203	MEASUREMENTS AND INSTRUMENTATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 BASIC MEASUREMENTS 9 hrs

Methods of Measurement, Measurement System, Classification of instrument system, Functional Elements of measurement system - Examples - Characteristics of instruments: Static characteristics - Dynamic characteristic Types of errors - sources of errors - methods of elimination - Analysis of data - Limiting errors - Relative limiting error - Combination of Quantities with limiting errors - Statistical treatment of data: Histogram, Mean, Measure of dispersion from the mean, Range, Deviation, Average deviation, Standard Deviation, Variance - Calibration and Standards - Process of Calibration.

UNIT 2 ELECTRICAL MEASUREMENTS 9 hrs

Units of voltage and current - principle of operation of D'Arsonval Galvanometer - principle, operation, constructional details and comparison of the following: permanent magnet moving coil, permanent magnet moving iron, Dynamometer, Induction, thermal and rectifier type instruments, Power measurement - Voltmeter ammeter method, Ammeter voltmeter method, Electro-dynamic wattmeter - Low power factor wattmeter

UNIT 3 MEASUREMENT OF RESISTANCE, INDUCTANCE AND CAPACITANCE 9 hrs

Low Resistance: Kelvin's double bridge - Medium Resistance: Voltmeter Ammeter method - Substitution method - Wheatstone bridge method. High Resistance: Megger - Direct deflection method - Megohm bridge method, Loss of Charge method - Earth resistance measurement. Introduction to A.C bridges Sources and Detectors in A.C. bridges. Measurement of Self Inductance: Maxwell's bridge - Hay's bridge, and Anderson's bridge. Measurement of Mutual Inductance: Heavy side M.I bridge - Measurement of Capacitance: Schering's bridge - Sauty's bridge, Measurement of frequency using Wien's bridge

UNIT 4 ELECTRONIC MEASUREMENTS 9 hrs

Fundamentals of Cathode Ray Oscilloscope: Block diagram, CRO probes, Delay line, types of Oscilloscopes. Measurement of: Signal voltage, Current, Phase & Frequency using Lissajous patterns, Industrial applications of CRO. DC and AC voltmeter and Ammeter, Ohmmeter, Range Extension, Electronic Multimeters, Types of Voltmeters - Differential type, true RMS type, Vector voltmeter - Wave Analyzer, Spectrum Analyzer and Distortion Analyzer

UNIT 5 DATA ACQUISITION 9 hrs

Introduction to ADC / DAC - Specifications, ADC Quantization Error, Types of ADC - Flash, Counter, Successive Approximation, Dual-Slope types and Introduction to Delta-Sigma, Types of DAC - Weighted-Resistor, 2R ladder and PWM type, ADC and DAC Problems - Smart sensors.

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the concepts of measurement systems and characteristics of instruments
CO2	Describe the construction and working of various types of instruments
CO3	Choose an appropriate instrument for the required measurement
CO4	Analyze the various characteristics of signals
CO5	Design a suitable conversion circuit for an application
CO6	Design an instrument to measure electrical and electronic parameters

TEXT / REFERENCE BOOKS:

1. Sawhney A.K., "A Course in Electrical, Electronic measurement & Instrumentation", Dhanbat Rai & sons, 1 8th Edition, Reprint 2010
2. B.Nagaraj, S.Renuka, B.RamPriya, "Transducer Engineering" Anuradha Publications, First edition, 2009
3. Doebelin E.O. "Measurement System Applications and Design", McGraw Hill, 5th Edition, 2004
4. Albert D. Helfrick & William. D. Cooper, "Modern Electronic Instrumentation & Measurement Techniques", PHI, 2003
5. Rick Bitter, Taqi Mohiuddin and Matt Nawrocki, 'Labview Advanced Programming Techniques', CRC Press, Second Edition, 2007
6. Rahman Jamal and Herbert Picklik, "LabVIEW - Applications and Solutions", National Instruments Release ISBN 0130964239
7. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2013
8. David Bell, 'Electronic Instrumentation & Measurements', Oxford University Press, 2013

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

S E C 4 0 5 8	ELECTRONIC CIRCUITS - I LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:

- 1 Transistor Biasing Circuits
- 2 Half wave Rectifier With and Without Filter
- 3 Voltage Regulator
- 4 Full wave Rectifier With and Without Filter using PSpice
- 5 Adders
- 6 Subtractors
- 7 Flip Flop using PSpice
- 8 Shift Registers
- 9 Counters
- 10 Code Converters
- 11 Common Source JFET using PSpice
- 12 Common Emitter BJT using PSpice

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the characteristics of semiconductor devices, logic gates and fundamentals of PSpice programming
CO2	Choose the suitable passive, active devices and logic gates for the circuit
CO3	Construct the circuit diagram / logic diagram for the given problem
CO4	Analyze the performance of circuit diagram and logic diagram
CO5	Evaluate the I/O characteristics / truth table for the circuit
CO6	Design and develop the electronic/digital circuits with in hardware/software

SEE4051	ELECTRICAL ENGINEERING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:

- 1 Open circuit characteristics of separately excited dc shunt generator
- 2 Load characteristics of self excited dc shunt generator
- 3 Load characteristics of dc Compound generator
- 4 Load characteristics of dc shunt motor
- 5 Load characteristics of dc series motor
- 6 Open circuit and short circuit test on single phase transformer
- 7 Load test on single phase transformer
- 8 Brake load test on three phase squirrel cage induction motor
- 9 Load test on single phase Induction motor
- 10 Wiring circuits for
A. Calling bell B. Stair case C. Fluorescent lamp D. Basic household wiring using switches, fuses, Indicator – lamps etc.,

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Interpret the basic wiring circuits
CO2	Rule on the connection of all the meters and electrical machines to perform a test on the machines
CO3	Analyze the speed control of the motor
CO4	Built a control mechanism for the output voltage of the generator
CO5	Determine the performance of electrical machines
CO6	Evaluate the efficiency of various DC & AC machines

SEE1202	ELECTROMAGNETIC THEORY	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 ELECTRIC FIELDS 9 hrs

Introduction - Concepts of Different Co-Ordinate Systems - Coulomb's Law, Electric Field Intensity, Electric Field due to Point Charge, Line Charge, Surface Charge and Volume Charge Distributions - Electric Flux Density - Gauss Law - Application of Gauss Law - Electric Potential - Potential Gradient - Divergence and Divergence Theorem - Poisson's and Laplace equation

UNIT 2 CONDUCTORS AND DIELECTRICS 9 hrs

Field due to Dipoles - Dipole Moment - Boundary Conditions at Dielectric and Conductor Surfaces - Capacitor and Capacitance of a System of Conductors - Energy Stored and Energy Density - Capacitance due to Spherical Shell, Coaxial cable and Two Wire Transmission Line - Electrostatic Potential Energy Associated with Different Charges

UNIT 3 MAGNETIC FIELDS 9 hrs

Current and Current Density - Conduction and Convection Current - Force on a Current Element - Biot- Savart's law - Force between Current Carrying Conductors - Torque on Closed Conductors - Ampere's Law- Magnetic Flux Density - Curl and Stokes Theorem - Magnetic Vector Potential - Boundary Condition at the Magnetic surfaces

UNIT 4 FARADAY'S LAWS OF ELECTROMAGNETIC INDUCTION 9 hrs

Faradays' Laws - Self and Mutual Inductance - Inductance of Solenoids, Torroids, Transmission Lines and Cables - Energy Stored and Density in Magnetic Circuits

UNIT 5 MAXWELL'S EQUATION AND ELECTROMAGNETIC WAVES 9 hrs

Concept of Displacement and Conduction Current - Modified Ampere's Circuital Law - Maxwell's Equations in point and Integral Forms - Wave Equations - Plane Waves in Free Space - Polarization - Poynting's Theorem and Poynting Vector and its Significance - Energy in Electromagnetic Field

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the various laws used in electromagnetic fields
CO2	Describe the various quantities in electric and magnetic field
CO3	Apply the different co-ordinate Systems for the various fields
CO4	Analyze electric field and magnetic field qualities at different boundaries
CO5	Evaluate the parameters using laws of Electromagnetics
CO6	Design Solenoids, Torroids, Transmission Lines and Cables etc.

TEXT / REFERENCE BOOKS:

1. K.A. Gangadhar, "Electromagnetic Field Theory (Including Antenna Wave Propagation", Khanna Publisher New Delhi, 2009
2. Karl.E.Lonngren, Sava.V.Savov, "Fundamentals of Electromagnetics with MATLAB", PHI, 2009
3. William Hayt, "Engineering Electromagnetics", Tata McGraw - Hill, New York, 7th Edition, 2012
4. R.Meenakumari & R.Subasri, "Electromagnetic Fields", New Age International Publishers, 4th Edition, 2010
5. E.C.Jordan & K.G.Balmain, "Electromagnetic Waves & Radiating Systems", Prentice- Hall, 2013
6. Sadiku MH, "Principles of Electromagnetics", Oxford University Press Inc, New Delhi, 6th Edition,2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

S E C 4 0 5 9	ELECTRONIC CIRCUITS-II LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:

- 1 Class C Power Amplifier
- 2 Cascode Amplifier
- 3 Single tuned Amplifier
- 4 Feedback Amplifier
- 5 Hartley Oscillator
- 6 Colpitts Oscillator
- 7 Waveform generation using CMOS gates
- 8 PRBS generator
- 9 Encoders
- 10 Decoders
- 11 Multiplexers
- 12 Demultiplexers

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the characteristics of amplifiers /oscillators and logic gates
CO2	Choose the suitable active devices and logic gates for the desired circuits
CO3	Construct the circuit/logic diagram for the given problem
CO4	Analyze the performance of circuit /logic diagram
CO5	Evaluate the input-output characteristics or truth table of circuit
CO6	Design and develop the electronic/digital circuits

SEC1402	PROGRAMMING IN HDL (For ECE and EEE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 BASIC CONCEPTS IN VHDL**9 hrs**

Digital system design process - Hardware simulation - Introduction to VHDL - Language elements of VHDL - Data objects - Data types - Operators - Signal assignments - Inertial delay mechanism - Transport delay mechanism - Variable assignments - Concurrent and Sequential assignments- Delta delay.

UNIT2 MODELING IN VHDL**9 hrs**

Data flow modeling - Concurrent Signal Assignment statements - **Structural modeling** - Component declaration - Component Instantiation - **Behavioral modeling** - Process statement - wait statement - Conditional and loop statements -Generics and configurations - Examples for modeling.

UNIT3 INTRODUCTION TO VERILOG HDL**9 hrs**

Basic concepts - Levels for design description - Module - Delays - Language elements - Compiler directives - value set - data types - Parameters - Expressions - Operands - operators in Verilog HDL.

UNIT4 STYLES OF MODELING**9 hrs**

Gate level modeling -**Primitive Gates**- Multiple input and multiple output gates - User Defined Primitives - Combination UDP - Sequential UDP- Data flow modeling - Behavioral modeling - procedural constructs - procedural assignments - conditional and loop statements - Structural Modeling - Examples for modeling.

UNIT5 FEATURES IN VERILOG HDL**9 hrs**

Tasks- Functions -systems tasks and functions - **Verification** - **Modeling a test bench** - timing and delays - Switch level modeling - state machine modeling - **Moore FSM – Melay FSM** - **Design of memories** - **Design of microcontroller CPUs.**

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Identify the use of HDL language in constructing digital logic circuits
CO2	Analyze the combinational sequential logic circuit in gate and switch level modeling
CO3	Conceptualize the system through design and modeling various architectures
CO4	Develop any design based upon the system requirements for solving real time problems
CO5	Validate and Verify the system design
CO6	Design a test bench for any logic circuit

TEXT / REFERENCE BOOKS:

1. J.Bhaskar, "A VHDL Primer", Pearson. 3rd edition, 2013
2. Douglas L. Perry, "VHDL Programming by Example", McGraw Hill, 4th edition, 2012
3. J.Bhaskar, "A Verilog HDL Primer", Star Galaxy Publishing. 3rd edition, 2011
4. Stephen Brown, "Fundamental of Digital logic with VHDL Design", Tata McGraw Hill, 3rd edition, 2012

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SEC1601	ADVANCED MICROPROCESSORS	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT1 ADVANCED MICROPROCESSOR ARCHITECTURE

9 hrs

Internal Microprocessor Architecture - Real mode memory addressing - Protected mode memory addressing - Memory paging – Data addressing modes - Program memory addressing modes - Stack memory addressing modes - Data movement instructions - Program control instructions - Arithmetic and Logic Instructions. Intel 80186 - Architecture.

UNIT 2 INTRODUCTION TO INTEL 80286, 80386 & 80486

9 hrs

Introduction to 80286 - Architecture, Real address mode & protected virtual address mode. 80386 Microprocessor - Architecture, Pins & Signals, Memory System Registers, 80386 operating modes - Paging Technique, Protected Mode Operation & Intel 80486 Architecture. Comparison of Microprocessors (8086 - 80286 - 80386 - 80486)

UNIT 3 PENTIUM PROCESSORS

9 hrs

Introduction to Pentium Microprocessor - Special Pentium registers - Branch Prediction Logic, Floating Point Module, Cache Structure, and Superscalar Architecture. Pentium memory management - New Pentium Instructions - Pentium Processor -Special Pentium pro features - Pentium 4 processor

UNIT4 RISC PROCESSORS

9 hrs

PowerPC-620 - Instruction fetching - Branch Prediction - Fetching - Speculation, Instruction dispatching - dispatch stalls - Instruction Execution - Issue stalls- Execution Parallelism - Instruction completion - Basics of P6 micro architecture - Pipelining - Memory subsystem

UNIT5 FEATURES IN VERILOG HDL

9 hrs

Conversion of Colour Models; Basic of Full-Colour Image Processing; Colour Transformations; Smoothing; Sharpening; Segmentation Applications of Image Processing - Motion Analysis, Image Fusion, Image Classification n;

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Understand the architecture of advanced microprocessors, addressing modes and control instruction
CO2	Illustrate the architectures and working of 80286,80386 and 80486
CO3	Analyze the Pentium processor and its pro features
CO4	Evaluate the RISC processor I and to use the features pipelining to solve problems
CO5	Implement RISC processor II in real time application
CO6	Develop algorithm/program of the advanced microcontrollers for a particular task

TEXT / REFERENCE BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", 2nd Edition, Pearson Education, Inc., 2004
2. Barry B.Brey , "The Intel Microprocessors 8086/8088, 8086, 80286, 80386, 80486, Pentium, Pentium Pro Processor, Pentium II, Pentium III, Pentium 4, Architecture, Programming and interfacing", Prentice Hall of India Private Limited, New Delhi, 2003
3. Alan Clements, "The Principles of computer Hardware", Oxford University Press, 3rd Edition, 2003
4. 4. John Paul Shen, Mikko H.Lipasti, "Modern Processor Design", Tata McGraw Hill, 2006

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SEC1603	AUTOMATIC SPEECH RECOGNITION	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 FUNDAMENTALS OF SPEECH SIGNAL

9 hrs

History of speech recognition research, The Speech Signal: Speech production mechanism, Classification of speech, sounds, nature of speech signal, models of speech production. Speech signal processing: purpose of speech processing, digital models for speech signal, Digital processing of speech signals, Significance, short time analysis

UNIT 2 TIME DOMAIN METHODS FOR SPEECH PROCESSING

9 hrs

Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation

UNIT3 FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING

9 hrs

Short time Fourier analysis, filter bank analysis, spectrographic analysis, Formant extraction, pitch extraction, Analysis - synthesis systems. Homomorphic Signal Processing

UNIT4 SPEECH ANALYSIS AND SPEECH RECOGNITION

9 hrs

Cepstral analysis of speech, formant and pitch estimation, Mel frequency cepstrum computation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification, Basic pattern recognition approaches, Parametric representation of speech, Evaluating the similarity of speech patterns, Isolated digit Recognition System, Continuous digit Recognition System. Vector quantization, speech coding

UNIT5 HIDDEN MARKOV MODEL FOR SPEECH RECOGNITION

9 hrs

Introduction to Hidden Markov Model (HMM), Types of HMM, Hidden Markov Model (HMM) for speech recognition, Viterbi algorithm, Training and testing using HMMs, Adapting to variability in speech (DTW), Language models. Example of speech recognition project

Max. 45 hrs

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Recognize and acquire knowledge about the fundamentals of speech production
CO2	Understand the application of Time domain analysis in speech signals
CO3	Comprehend the application of Time and frequency domain analysis in speech signals
CO4	Implement the analyses of speech signals in speech recognition applications
CO5	Representation of speech signals using the parametric methods of Hidden Markov model for speech recognition
CO6	Will be able to develop a speech processing and recognition system using various mathematical models and signal analysis tools

TEXT / REFERENCE BOOKS:

1. L. Rabiner and B.-H. Juang, "Fundamentals of Speech Recognition", Prentice Hall, 1995, ISBN 0-1 3-01 51 57-2
2. L. R. Rabiner and R. W. Schafer, "Digital Processing of Speech Signals", Prentice-Hall, 1978, ISBN 0-13-213603-1
3. Douglas O'Shaughnessy, "Speech Communications: Human & Machine" -, 2nd ed., IEEE Press
4. Thomas F. Quateri, "Discrete Time Speech Signal Processing: Principles and Practice" - 1st Ed., PE
5. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", Wiley

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SEC1616	PATTERN RECOGNITION AND IMAGE VISION (Common to ETCE, E&C & EIE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 PRINCIPLES OF PATTERN RECOGNITION

9 hrs

Patterns and features, training and learning in pattern recognition approach, different types of pattern recognition. Statistical pattern recognition, feature selection, syntactic pattern recognition, clustering and non-supervised learning methods.

UNIT 2 OBJECT DETECTION METHODOLOGIES

9 hrs

Combined detection method, edge detection, edge linking, gradient. Laplacian, line detection, method based, point detection, snake methods. Boundary description detection, matching, merges segmentation, smoothing, splitting of boundaries syntactic, analysis of region boundaries, study of shape by region analysis.

UNIT 3 PATTERN CLASSIFICATION

9 hrs

DISTANCE FUNCTIONS - Pattern classification by distance functions - Minimum distance classification - Cluster and cluster seeking algorithms - Pattern classification by likelihood functions. STATISTICAL FUNCTIONS - Pattern classification using Statistical classifiers - Bayes' classifier - Classification performance measures - Risk and error probabilities.

UNIT 4 PATTERN RECOGNITION

9 hrs

FUZZY CLASSIFIERS - Fuzzy and crisp classification - Fuzzy clustering - Fuzzy pattern recognition - Syntactic pattern recognition- Selection of primitives - Syntax analysis for pattern recognition. **NEURAL CLASSIFIERS**- Introduction - Neural network structures for PR, Neural network based pattern associators - Feed forward networks trained by back propagation - ART networks.

UNIT 5 IMAGE EXTRACTION CONCEPTS

9 hrs

Introduction of Computer Vision, Computer Imaging System, Image Formation and sensing CVIP tools Software, Image representation. **Area Extraction**: Concepts, Data-structures, Edge, Line- Linking, Hough transform, Line fitting, Curve fitting.

Introduction **BOUNDARY ANALYSIS AND MATCHING** Region Analysis: Region properties, External points, spatial moments, mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers. General Frame Works for Matching: Distance relational approach,

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Understand the fundamentals of Pattern Recognition
CO2	Learn the various approaches to identify the patterns
CO3	Implement pattern classification
CO4	Analyze the fuzzy classifiers
CO5	Illustrate the concept of image extraction on computer vision
CO6	Apply the appropriate techniques on the real time application development

TEXT/REFERENCE BOOKS:

1. Dude, Hart, and Stock, "Pattern Classification", John Wiley and Sons, 2nd Edition, 2001
2. Gose, Johnsonbaugh and Jost, "Pattern Recognition and Image Analysis", Prentice Hall; Har/Dsk Edition, 1996
3. D. Forsyth and J. Ponce, "Computer Vision - A modern approach", Prentice Hall
4. Robot Vision, by B. K. P. Horn, McGraw-Hill
5. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 2007
6. Robert Haralick and Linda Shapiro, "Computer and Robot Vision", Vol I & II, Addison-Wesley, 1993
7. Christopher M Bishop, "Neural Network for pattern recognition", Oxford university press, 2008

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

		L	T	P	Credits	Total Marks
SEC1617	ADVANCED ELECTRONIC TEST ENGINEERING	3	0	0	3	100

UNIT1 INTRODUCTION TO PCB TECHNOLOGY 9hrs

Printed Circuit Boards(PCB) - Construction - Types of PCB - Multilayer - Surface Mount technology – PCB Manufacturing process - PCB Inspection methods - Bare Board Testing - Optical and X-Ray Inspection - Electrical tests -Text fixtures - Bed of nails fixtures - Cross talk test - Mock up test - In circuit test – Burn-in-test - Fault diagnostic methods. Electromagnetic compatibility testing of electronic components, subassemblies, Measuring Instruments and systems

UNIT2 PCB TROUBLE SHOOTING PROCESS 9 hrs

Symptom Recognition - Bracketing Technique - Component failure Analysis - Fault types and causes in circuits- during manufacturing - Manual trouble shooting technique - Tools and Instruments DMM - CRO - PCO - Logic probes- Logic pulsar - Logic Analyzer

UNIT3 AUTOMATED TROUBLE SHOOTING TECHNIQUES 9 hrs

ATE Techniques - CPU Emulator technique - ROM and ROM Emulators - In circuit Comparator - In Circuit Functional test - Trouble shooting digital gates - Testing Linear Integrated Circuits - Guarding Technique - VI trace Technique - Bus Cycle Signature System - Board functional test methods - Boundary scan test basics

UNIT4 ATE SYSTEM ARCHITECTURE 9 hrs

ATE System Components - Digital Pin Electronics - Drive data formats - Digital High way - Analog Highway – Test Vector Generation - Creating test patterns - Fault Simulations. Technique - Bus Cycle Signature System - Board functional test methods - Boundary scan test basics

UNIT5 DESIGN FOR TESTABILITY (DFT) 9 hrs

MDA test systems - Boundary scan test with I/O pin compatibility - Automatic optical inspection systems - Combinational ATE Systems - Design for testability - Observability and Controllability - Testing Flow diagram - Stuck at fault model - Fault simulation - Ad Hoc technique - Scan design technique - Basics of ATPG - BIST-Test pattern generation for built in self test - Exhaustive pattern generation and deterministic testing - Output response Analysis - Transition count syndrome checking - Signature Analysis - Circular BIST

Max. 45 hrs

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Identify various types of printed circuit boards and effectively use testing tools
CO2	Describe the working of automated test equipments
CO3	Identify faults in assembled PCBs using automated test equipments both at component level and board level
CO4	Design board fixtures to carry out customized board level testing
CO5	Develop test vectors and test patterns for fault identification in custom PCBs
CO6	Design and implement electronic systems with testability architectures

TEXT / REFERENCE BOOKS:

- 1 Michael L.Bushnell et al., "Essentials of Electronic testing for digital, memory and mixed signal VLSI circuit", 1st edition, Academic Press, 2002
- 2 Parag.K.lala, "Digital circuit Testing and Testability", 1st edition, Academic press, 2001
- 3 Alfred L.Crouch, "Design for test for Digital ICs and Embedded core systems", 2nd edition, PHI, 1999
- 4 Sabapathy S.R., "Test Engineering for electronic hardware", Qmax publishers, 1st Edition, 2007

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 hrs

Part A: 10 questions of 2 marks each -No choice

20 Marks

Part B: 5 questions from each unit with internal choice, each carrying 16 marks

80 Marks

SCS1315	COMPUTER ARCHITECTURE AND OPERATING SYSTEM	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT 1 INTRODUCTION**9 hrs**

Central Processing Unit - Introduction - General Register Organization - Stack organization -- Basic computer Organization - Computer Registers - Computer Instructions - Instruction Cycle. Arithmetic, Logic, Shift, Micro operations- Arithmetic Logic Shift Unit -Example Architectures: MIPS, Power PC, RISC, CISC

UNIT2 CONTROLUNIT DESIGN AND MULTIPROCESSORS**9 hrs**

Micro programmed Control: Control memory - address sequencing - Micro program Example- Design of Control unit -Example Processor design Multiprocessors: Characteristics- Interprocessor Arbitration- Interprocessor Communication

UNIT 3 MEMORY AND I/O SYSTEM**9 hrs**

Memory Organization: Memory Hierarchy - Main memory - auxiliary Memory - Associative Memory - Cache Memory - Virtual memory Input - Output Organization: Peripheral Devices - I/O Interface, Modes of transfer – Priority Interrupt - DMA -IOP - Serial Communication

UNIT4 INTRODUCTION**9 hrs**

Introduction - Operating system structures - System components - OS services - Process Management: Processes – Process concepts - Process scheduling-- CPU scheduling- Scheduling algorithms - Preemptive strategies - Non-preemptive strategies

UNIT5 DEADLOCKS AND MEMORY MANAGEMENT**9 hrs**

The critical section problem - Semaphores - Deadlocks - Deadlock characterization - Prevention – Avoidance – Detection - Recovery. Storage Management Strategies - Contiguous vs. non-contiguous storage allocation- Paging - Segmentation - Paging/Segmentation systems - Page replacement strategies

COURSE OUTCOMES:

On completion of this course, students are able to

CO1	Describe the micro level dataflow in various units of computer
CO2	Demonstrate the impact of control memory operations and multi-processor characteristics
CO3	Examine the different types of memory and experimenting the mapping techniques
CO4	Select the suitable process scheduling technique for optimized function of operating systems
CO5	Critically appraise the deadlock in CPU and other memory management techniques
CO6	Develop an optimized architecture for stand-alone applications

TEXT / REFERENCE BOOKS:

1. M.Morris Mano, "Computer System Architecture", Prentice-Hall Publishers, Third Edition,2007
2. John P Hayes, 'Computer Architecture and Organization', McGraw Hill international edition, Third Edition,2007
3. Kai Hwang and Faye A Briggs, 'Computer Architecture and Parallel Processing', McGraw Hill International edition.
4. Abraham Silberschatz,Peter Galvin and Gagne, "Operating System Concepts", 6th Edition, Addison Wesley, 2002
5. Harvey M.Deitel, "Operating System", 2nd Edition, Addison Wesley, 2000

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****Exam Duration: 3 hrs****Part A:** 10 questions of 2 marks each -No choice**20 Marks****Part B:** 5 questions from each unit with internal choice, each carrying 16 marks**80 Marks**

SCS4201	OBJECT ORIENTED PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE CONTENTS:

1	Develop a C++ program to implement a class, object creation, member function invocation concept	4 hrs
2	Develop a C++ program to implement the various constructors and destructor concept	3 hrs
3	Develop a C++ program to implement a friend function, Inline function	3 hrs
4	Develop a C++ program to implement an operator (Unary & Binary) overloading concept	5 hrs
5	Develop a C++ program to implement a function overloading concept	3 hrs
6	Develop a C++ program to implement a run time polymorphism	4 hrs
7	Develop a C++ program to implement the following inheritance types: a. Single b. Multiple c. Multilevel d. Hierarchical e. Hybrid	6 hrs
8	Develop a C++ program to implement an Abstract class concept.	4 hrs
9	Develop a C++ program to implement a Virtual function.	4 hrs
10	Develop a C++ program to find the number of characters in a file	4 hrs
11	Develop a C++ program to handle the exceptions.	5 hrs

COURSE OUTCOMES:

On completion of the course, students are able to

CO1	Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects
CO2	Explain the difference between object-oriented programming and procedural oriented language and data types in C++
CO3	Describe dynamic memory management techniques using pointers, constructors, destructors, etc.
CO4	Describe the concept of function overloading, operator overloading, virtual functions and polymorphism
CO5	Classify inheritance with the understanding of early and late binding, usage of exception handling, generic programming
CO6	Develop program using C++ features such as composition of objects, Operator overloading, inheritance, Polymorphism etc

SATHYABAMA UNIVERSITY

(Established under section 3 of UGC Act, 1956)

Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai –600119.



SYLLABUS

**BACHELOR OF ENGINEERING PROGRAMME
IN
ELECTRONICS AND COMMUNICATION ENGINEERING**

(8 SEMESTERS)

REGULATIONS 2010

SATHYABAMA UNIVERSITY

REGULATIONS - 2010

Effective from the academic year 2010-2011 and applicable to the students admitted to the Degree of Bachelor of Engineering / Technology. (Eight Semesters)

1. STRUCTURE OF PROGRAMME

- 1.1 Every Programme will have a curriculum with syllabi consisting of theory and practical such as:
 - (i) General core courses comprising Mathematics, Basic Sciences, Engineering Sciences.
 - (ii) Core course of Engineering / Technology.
 - (iii) Elective course for specialization in related fields.
 - (iv) Workshop Practice, Computer Practice, Engineering Graphics, Laboratory Work, Industrial Training, Seminar Presentation, Project Work, Educational Tours, Camps etc.
- 1.2 Each semester curriculum shall normally have a blend of lecture courses not exceeding 7 and practical courses not exceeding 4.
- 1.3 The medium of instruction, examinations and project report will be in English.

2. DURATION OF THE PROGRAMME

A student is normally expected to complete the B.E/B.Tech. Programme in 8 semesters but in any case not more than 12 consecutive semesters from the time of commencement of the course (not more than 10 semesters for those who join 3rd semester under Lateral entry system) The Head of the Department shall ensure that every teacher imparts instruction as per the number of hours specified in the syllabus and that the teacher teaches the full content of the specified syllabus for the course being taught.

3. REQUIREMENTS FOR COMPLETION OF A SEMESTER

A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirement for completion of a semester.

- 3.1 He/She secures not less than 90% of overall attendance in that semester.
- 3.2 Candidates who do not have the requisite attendance for the semester will not be permitted to write the University Exams.

4. EXAMINATIONS

The examinations shall normally be conducted between October and December during the odd semesters and between March and May in the even semesters. The maximum marks for each theory and practical course (including the Project work and Viva Voce examination in the Eighth Semester) shall be 100 with the following breakup.

(i) Theory Courses

Internal Assessment: 20 Marks

University Exams : 80 Marks

(ii) Practical Courses

Internal Assessment: - -

University Exams : 100 Marks

5. PASSING REQUIREMENTS

- (i) A candidate, who secures not less than 50% of total marks prescribed for the courses (For all courses including Theory, Practicals and Project work) with a minimum of 35 marks out of 80 in the University Theory Examinations, shall be declared to have passed in the Examination.
- (ii) If a candidate fails to secure a Pass in a particular course, it is mandatory that he/she shall reappear for the examination in that course during the next semester when examination is conducted in that course. However the Internal Assessment marks obtained by the candidate in the first attempt shall be retained and considered valid for all subsequent attempts.

6. ELIGIBILITY FOR THE AWARD OF DEGREE

A student shall be declared to be eligible for the award of the B.E/B.Tech. Degree provided the student has successfully completed the course requirements and has passed all the prescribed examinations in all the 8 semesters within the maximum period specified in clause 2.

7. AWARD OF CREDITS AND GRADES

All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, Letter Grades will be awarded as per the range of total marks (out of 100) obtained by the candidate as given below:

RANGE OF MARKS FOR GRADES

Range of Marks	Grade	Grade Points (GP)
90-100	A++	10
80-89	A+	9
70-79	B++	8
60-69	B+	7
50-59	C	6
00-49	F	0
ABSENT	W	0

CUMULATIVE GRADE POINT AVERAGE CALCULATION

The CGPA calculation on a 10 scale basis is used to describe the overall performance of a student in all courses from first semester to the last semester. F and W grades will be excluded for calculating GPA and CGPA.

$$CGPA = \frac{\sum C_i GP_i}{\sum C_i}$$

where C_i - Credits for the subject

GP_i - Grade Point for the subject

i - Sum of all subjects successfully cleared during all the semesters

8. CLASSIFICATION OF THE DEGREE AWARDED

1. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 8 semesters in his/her first appearance within a maximum period of 8 consecutive semesters after commencement of study (maximum of 6 semesters for Lateral entry system who join the course in the third semester) securing a **CGPA not less than 9.0** shall be declared to have passed the examination in **First Class – EXEMPLARY**.
2. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 8 semesters in his/her first appearance within a maximum period of 8 consecutive semesters after commencement of study (maximum of 6 semesters for Lateral entry system who join the course in the third semester) securing a **CGPA not less than 7.5** shall be declared to have passed the examination in **First Class with Distinction**.
3. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 8 semesters within a maximum period of 8 consecutive semesters after commencement of study (maximum of 6 semesters for Lateral entry system who join the course in the third semester) securing a **CGPA not less than 6.0** shall be declared to have passed the examination in **First Class**.
4. All other candidates who qualify for the award of the Degree having passed the examination in all the courses of all the 8 semesters within a maximum period of 12 consecutive semesters (10 consecutive semesters for Lateral Entry system who join the course in the third semester) after his/her commencement of study securing a **CGPA not less than 5.0** shall be declared to have passed the examination in **Second Class**.
5. A candidate who is absent in semester examination in a course/project work after having registered for the same, shall be considered to have appeared in that examination for the purpose of classification of degree. **For all the above mentioned classification of Degree, the break of study during the programme will be counted for the purpose of classification of degree.**
6. A candidate can apply for revaluation of his/her semester examination answer paper in a theory course, within 1 week from the declaration of results, on payment of a prescribed fee along with prescribed application to the Controller of Examinations through the Head of Department. The Controller of Examination will arrange for the revaluation and the result will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

Final Degree is awarded based on the following:

CGPA ³ 9.0	- First Class - EXEMPLARY
CGPA ³ 7.50 < 9.0	- First Class with Distinction
CGPA ³ 6.00 < 7.50	- First Class
CGPA ³ 5.00 < 6.00	- Second Class

A minimum CGPA requirement for award of Degree is 5.0 CGPA.

9. DISCIPLINE

Every student is required to observe disciplined and decorous behaviour both inside and outside the University and not to indulge in any activity which will tend to bring down the prestige of the University. If a student indulges in malpractice in any of the University theory / practical examination, he/she shall be liable for punitive action as prescribed by the University from time to time.

10. REVISION OF REGULATIONS AND CURRICULUM

The University may revise, amend or change the regulations, scheme of examinations and syllabi from time to time, if found necessary.

**B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
REGULATIONS 2010 – CURRICULUM**

SEMESTER I

SI.NO	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
THEORY							
1	SHSX1001	English for Science and Technology	3	0	0	3	6
2	SMTX1001	Engineering Mathematics I	3	1	0	4	8
3	SPHX1001	Physics of Materials	3	0	0	3	10
4	SCYX1001	Engineering Chemistry	3	0	0	3	12
5	SCSX1002	Programming in C	3	0	0	3	14
6	SPRX1001	Basic Mechanical and Civil Engineering	3	0	0	3	16
7	SEEX1001	Basic Electrical Engineering	2	1	0	3	18
PRACTICAL							
8	SPHX4001	Physics Lab I	0	0	2	1	20
9	SCYX4001	Chemistry Lab I	0	0	2	1	21
10	SCSX4002	Programming in 'C' Lab	0	0	4	2	22
Total Credits: 26							

SEMESTER II

SI.NO	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
THEORY							
1	SCHX1001	Environmental Science and Engineering	3	0	0	3	23
2	SMTX1002	Engineering Mathematics II	3	1	0	4	25
3	SPHX1002	Applied Physics	3	0	0	3	27
4	SCYX1002	Chemistry of Electronic Materials	3	0	0	3	29
5	SMEX1001	Engineering Graphics	1	2	0	3	31
6	SEEX1004	Electrical Technology	2	1	0	3	33
7	SECX1001	Electronic Devices	3	0	0	3	35
PRACTICAL							
8	SEEX4001	Electrical Engineering Lab	0	0	4	2	37
9	SECX4001	Electronic Devices Lab	0	0	4	2	38
Total Credits: 26							

L - Lecture hours; T - Tutorial hours; P - Practical hours; C - Credits

SEMESTER III

SI.NO	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
THEORY							
1	SMTX1009	Engineering Mathematics III	3	1	0	4	39
2	SEEX1005	Circuit Theory	3	1	0	4	41
3	SECX1012	Electronic Circuits I	3	0	0	3	43
4	SECX1003	Engineering Electromagnetics	3	1	0	4	45
5	SCSX1014	Object Oriented Programming	3	0	0	3	47
6	SECX1002	Digital Systems	3	0	0	3	49
7	SECX1016	Analog Communication	3	0	0	3	51
PRACTICAL							
8	SECX4003	Electronic Circuits Lab I	0	0	4	2	53
9	SECX4004	Circuits and Networks Lab	0	0	4	2	54
Total Credits: 28							

SEMESTER IV

SI.NO	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
THEORY							
1	SMTX1010	Engineering Mathematics IV	3	1	0	4	55
2	SECX1013	Electronic Circuits II	3	0	0	3	57
3	SECX1004	Signals and Systems	3	0	0	3	59
4	SCSX1013	Data Structures	3	0	0	3	61
5	SECX1005	Network Analysis and Synthesis	3	0	0	3	63
6	SECX1006	Transmission Lines and Waveguides	3	0	0	3	65
PRACTICAL							
7	SCSX4008	Data Structures and OOPS Lab	0	0	4	2	67
8	SECX4005	Electronic Circuits Lab II	0	0	4	2	68
Total Credits: 23							

SEMESTER V

SI.NO	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
THEORY							
1	SMTX1011	Applied Numerical methods	3	1	0	4	69
2	SICX1003	Measurements and Instrumentation	3	0	0	3	71
3	SECX1027	Principles of Communication Theory	3	0	0	3	73
4	SECX1028	Digital Signal Processing	3	1	0	4	75
5	SECX1029	Antennas and wave Propagation	3	1	0	4	77
6	SEEX1010	Control Systems	3	1	0	4	79
7	SECX1007	Analog Integrated Circuits	3	0	0	3	81
PRACTICAL							
8	SECX4008	Analog Integrated Circuits Lab	0	0	4	2	83
9	SECX4009	Communication Engineering Lab	0	0	4	2	84
Total Credits: 29							

SEMESTER VI

SI.NO	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
THEORY							
1	SECX1031	Communication systems	3	0	0	3	85
2	SCSX1015	Database Management systems	3	0	0	3	87
3	SECX1032	Microprocessor Interfacing and Applications	3	0	0	3	89
4	SECX1033	Digital Communication	3	0	0	3	91
5		Elective I	3	0	0	3	
6		Elective II	3	0	0	3	
PRACTICAL							
7	SECX4010	Microprocessor and Microcontroller Lab	0	0	4	2	93
8	SECX4011	Digital Signal Processing Lab	0	0	4	2	94
Total Credits: 22							

SEMESTER VII

SI.NO	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
THEORY							
1	SECX1034	Telecommunication Switching systems	3	0	0	3	95
2	SECX1035	Cellular and Mobile Communication	3	0	0	3	97
3	SECX1036	Computer Communication	3	0	0	3	99
4	SECX1023	Programming in HDL	3	0	0	3	101
5		Elective III	3	0	0	3	
6		Elective IV	3	0	0	3	
PRACTICAL							
7	SECX4012	Hardware Description Language Lab	0	0	4	2	103
Total Credits: 20							

SEMESTER VIII

SI.NO	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
THEORY							
1	SECX1037	Microwave Engineering	3	0	0	3	104
2	SBAX1001	Principles of Management and Professional Ethics	3	0	0	3	106
3	SECX1038	Optical Communication	3	0	0	3	108
PRACTICAL							
4	SECX4013	Microwave, Optical and Simulation Lab	0	0	4	2	110
5	S13XPROJ	Project work and Viva-Voce	0	0	30	15	
Total Credits: 26							
Total Credits for the Course: 200							

LIST OF ELECTIVES

Note: ONE SUBJECT IS TO BE CHOSEN FROM EACH GROUP COMPULSORILY

Group I: COMMUNICATION ENGINEERING

SI.NO	SUBJECT CODE	SUBJECT TITLE	L	T	P	C	Page No.
1	SECX1051	Satellite Communication	3	0	0	3	111
2	SECX1052	Wireless Communication	3	0	0	3	113
3	SECX1060	Radar and Navigational aids	3	0	0	3	115
4	SECX1043	Television Engineering	3	0	0	3	117
5	SECX1061	Spread Spectrum Communication	3	0	0	3	119
6	SECX1062	Integrated Services Digital Networks	3	0	0	3	121
7	SECX1055	Mobile Ad-Hoc networks	3	0	0	3	123

Group II: ELECTRONICS/ MANAGEMENT

8	SECX1049	Microcontroller and Embedded Systems	3	0	0	3	125
9	SECX1040	Digital Image Processing	3	0	0	3	127
10	SECX1042	Advanced Electronic Test Engineering	3	0	0	3	129
11	SECX1057	Audio Signal Processing	3	0	0	3	131
12	SMEX1017	Resource Management Techniques	3	0	0	3	133

Group III: VLSI & INSTRUMENTATION

13	SECX1020	Nano Electronics	3	0	0	3	135
14	SECX1022	MEMS and its applications	3	0	0	3	137
15	SECX1019	CMOS VLSI design	3	0	0	3	139
16	SICX1020	Theory of Robotics & Automation	3	0	0	3	141
17	SICX1009	Bio-medical Instrumentation	3	0	0	3	143
18	SEEX1013	Power Electronics	3	0	0	3	145
19	SICX1016	Fundamentals of Mechatronics	3	0	0	3	147

Group IV: COMPUTER SCIENCE AND ENGINEERING

20	SECX1048	Fundamentals of Fuzzy Logic and Artificial Neural networks	3	0	0	3	149
21	SECX1041	Programming in MATLAB	3	0	0	3	151
22	SECX1059	Pattern Recognition and Image vision	3	0	0	3	153
23	SCSX1051	PC & PC Based Systems	3	0	0	3	155
24	SCSX1021	Artificial Intelligence	3	0	0	3	156
25	SCSX1016	Web Technology	3	0	0	3	158
26	SCSX1052	Information Highway	3	0	0	3	160

	MEASUREMENTS AND INSTRUMENTATION	L	T	P	Credits	Total Marks
SICX1003	(Common to ECE, ETCE, EEE)	3	0	0	3	100

Course Objectives:

1. To impart knowledge on measurement systems and characteristics.
2. To understand the different types of transducers.
3. To explain the construction and working of instruments u Resistance, Inductance, Capacitance.
4. To analyze the construction and working of signal generators, and multimeter.
5. To compare the different types of storage and display instruments.

UNIT I BASIC MEASUREMENTS**8 hrs**

Functional Elements of measurement system- Examples - Characteristics of instruments: Static characteristics - Dynamic characteristics - Types of errors -sources of errors- methods of elimination-Analysis of data - Limiting errors- Relative limiting error-Combination of Quantities with limiting errors – Statistical treatment of data: Histogram, Mean, Measure of dispersion from the mean, Range, Deviation, Average deviation, Standard Deviation, Variance- Calibration and Standards- Process of Calibration.

UNIT II TRANSDUCERS**10 hrs**

Transducers –Classification of Transducers, Characteristics - Basic Requirements of a Transducer- Resistive Transducer: Strain Gauge - Inductive Transducer: Linear Variable Differential Transducer - Capacitive displacement transducer, Load cell - Piezoelectric Transducers - Digital transducers – Thermoelectric transducers : Thermocouple, Thermistor, Radiation Pyrometers- Interfacing transducers to measurement systems: IEEE488.

UNIT III ELECTRICAL MEASUREMENTS**10 hrs**

Measurement of Voltage and Current: D'Arsonval Galvanometer, permanent magnet moving coil, permanent magnet moving iron, Dynamometer - Measurement of Resistance, Inductance and Capacitance: Wheat stone bridge, Kelvin double bridge, Wein Bridge, Hay's bridge, Maxwell bridge, Anderson bridge, Schering bridge – ohmmeter, VOM meter.

UNIT IV ELECTRONIC MEASUREMENTS**10 hrs**

Signal generators: Function Generators – RF Signal Generators – Sweep generators- Wave Analyzer- Harmonic Distortion Analyzer - Spectrum Analyzer - DC & AC Voltmeters – Digital Voltmeters- Types- Automatic polarity indication, Automatic Ranging, Auto Zeroing- Electronic Multimeters – Digital Multimeters – Frequency Counters- Measurement of Frequency and Time Interval

UNIT V STORAGE AND DISPLAY INSTRUMENTS**12 hrs**

Cathode Ray Oscilloscopes - Storage Oscilloscope - Digital Storage Oscilloscope – Sampling CRO - Dual Trace Oscilloscopes – Electromechanical servo type XT & XY recorders - LED, LCD, Dot Matrix Display – Magnetic Tape and Disk Recorders/ Reproducers.

Course Outcomes

On completion of the course, student will be able to–

CO1	Understand the measurement systems and characteristics of instruments.
CO2	Choose the transducer for a particular measurement.
CO3	Explain the construction and working principle of instruments applied for electrical and electronic measurements.
CO4	Compare the different types of display instruments.
CO5	Design an instrument to measure any electrical and electronic parameters.

TEXT BOOKS/ REFERENCE BOOKS:

1. A.K.Sawhney," Electrical, Electronic measurement & Instrumentation", Dhanpat Rai & sons,18th Edition, Reprint 2010
2. DoeblienE..O. "Measurement System Applications and Design", McGraw Hill , 5th Edition,2004.
3. Albert.D.Helfrick&William.D.Cooper, "Modern Electronic Instrumentation & Measurement Techniques", PHI , 2003.
4. E.W. Golding and F.C. Widdis, "Electrical Measurements and measuring Instruments", V Edition, Wheeler Publications
5. Alan S.Morris, "Principles of Measurements & Instrumentation", PHI , 2nd Edition, 2003

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 hrs****PART A** :2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B** :2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SECX1027	PRINCIPLES OF COMMUNICATION THEORY	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To impart knowledge on probability theory.
2. To discuss about the various characteristic functions of probability theory.
3. To understand the concept of random signal theory.
4. To analyze the behavior using source coding.
5. To analyze the various modeling of noise.

UNIT I PROBABILITY THEORY

10 hrs

Introduction to probability, Conditional probability and statistical independence, joint and conditional probability, Independent events – Gaussian & Rayleigh density functions - Random variables- Discrete and continuous – statistical averages – characteristic function – central limit theorem.

UNIT II RANDOM SIGNAL THEORY

10 hrs

Random process- stationary – Ergodicity - Correlation and covariance- Power spectral density – Wiener – Kinchine Relation - Relation between PSD of input and output random process – transmission of random process through networks

UNIT III INFORMATION THEORY- Measure of information

10 hrs

Unit of information Discrete memory less source-Conditional entropies and joint entropies – Basic relationship among different entropies – Mutual information and trans information – Efficiency and redundancy – Shannon's theorem – Discrete memory less channels- Channel representation – Noise less and loss less channels – BSC & BEC channel and channel capacities

UNIT IV SOURCE CODING

10 hrs

Purpose of encoding – Coding efficiency – channel theorem of coding – (Uniquely decipherable codes and Instantaneous codes – Crafts inequality – Extension code) Shannon Fano code – Huffman's minimum redundancy code – cyclic & block codes – convolutional codes.

UNIT V MODELING & SIGNAL DETECTION IN NOISE

10 hrs

Modeling of Noise sources – thermal noise – noise spectral density – noise temperature – noise bandwidth – noise figure – effective noise temperature – friss formula – narrow band noise – quadrature representation of narrow band noise. Hypothesis testing – Baye's Criterion minimum probability error criterion-Neymanpearson criterion–mini max criterion, max min Criterion likely hood detector – Matched filter – Weiner filter

Course Outcomes

On completion of the course, student will be able to–

CO1	Classify various types of probability theory
CO2	Characterize and analyze the various characteristics of probability theory
CO3	Demonstrate the usage of random signal theory
CO4	Describe the concept of various source coding
CO5	Implement the concept of signal detection and modeling of noise

TEXT / REFERENCE BOOKS:

1. Srinath and Rajasekar, "Introduction to statistical theory of communication", 2nd Edition, 1996, PHI..
2. Eugene Xavier S.P., "Statistical of Theory of Communication", 1st Edition, New Age International.
3. Singh R.P. and Sapre S.D., "Communication Systems", 2nd Edition, TMH, New Delhi
4. Thomas JB, "Statistical theory of communication", Wiley
5. Ziemer and Tranter, "Principles of communication" 6th Edition, Wiley.
6. Sam Shanmugam, "Analog and Digital Communication", John Wiley, 1996.
7. Hancock H.C., "Introduction to principles of communication theory".

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 hrs****PART A :** 2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B :** 2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SECX1028	DIGITAL SIGNAL PROCESSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To impart knowledge of System representation in time domain and Frequency domain, Auto correlation, convolution, Discrete and Fast Fourier transform.
2. To discuss analysis and design of Digital filters using different methods.
3. To analyze the various realization structures for FIR,IIR filters and to understand finite word length effects.
4. To understand the concept of Multirate signal processing.
5. To study the architecture, programming concepts of DSP processor.

UNIT I DFT AND FFT

10 hrs

Review of Time domain and Frequency domain representation of DTLTI system – Discrete random signals – Averages – Auto correlation and power spectral density – DFT – Properties – Linear and Circular convolution – FFT – Decimation in time FFT and Decimation in frequency FFT algorithms – Inverse DFT – Applications of FFT to convolution.

UNIT II ANALYSIS AND DESIGN OF DIGITAL FILTERS

10 hrs

Review Butterworth and Chebyshev approximations – Properties of IIR and FIR filters – Design of IIR filter using Impulse invariant and Bilinear transformation method – Design of FIR filter using window method – rectangular, Hanning hamming, Kaiser windows.

UNIT III EFFECT OF FINITE REGISTER LENGTH

10 hrs

Realization structure for FIR & IIR filters – Direct Form I and Direct Form II, cascade, parallel realization – Effect of number representation in registers – fixed point arithmetic – floating point arithmetic – Errors due to rounding – ADC quantization noise – coefficient quantization error – product quantization error – truncation – limit cycles due to product round off error – addition of over flow errors – Scaling – dynamic range.

UNIT IV MULTI RATE DIGITAL SIGNAL PROCESSING

10 hrs

Introduction- Concepts of Multirate Signal Processing- Decimation by integer factor- interpolation by integer factor - Sampling rate conversion by non integer factor – multistage approach to sampling rate conversion – Application: echo cancellor, efficient digital to analog Conversion in compact hi-fi systems.

UNIT V DIGITAL SIGNAL PROCESSORS

10 hrs

TMS320C5412 family – Architecture – Addressing mode – Instruction set- Simple programs – Introduction to code composer studio software – Simulation.

Course Outcomes:

On completion of the course, student will be able to–

CO1	Classify various types of System representation and the application of transforms.
CO2	Illustrate Digital filter design techniques
CO3	Demonstrate various digital filter realization structures and finite word length effects.
CO4	Describe the concept of multi-rate signal processing and its applications.
CO5	Implement DSP Processor based applications in the field of signal processing.

TEXT / REFERENCE BOOKS:

1. SanjitK.Mitra, "Digital signal Processing A Computer Based Approach", 3rd Edition, Mc Graw Hill, 2006.
2. J.G.Prokias, "Digital Signal Processing", 2nd Edition, Prentice Hall, 1996.
3. Rabiner and Gold, "Theory and application of Digital Signal Processing", Prentice Hall, 2007.
4. Oppenheim and Schafer, "Digital Time Signal Processing", 2nd Edition, Prentice Hall, 1999.
5. Ashok Ambarder, "Digital Signal Processing", 1st Edition, Cengage learning, 2006.
6. Venkataramani, "Digital Signal Processors", Tata Mc Graw Hill, 14th reprint of 2008.
7. John G Proakis and Dimtris G Manolakis, Digital Signal Processing, 3rd Edition, PHI Pearson Education, 2000.
8. P.RameshBabu et al., Digital Signal Processing, 4th Edition, Scitech Publishers, Reprint 2010

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 hrs****PART A** : 2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B** : 2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SECX1029	ANTENNAS AND WAVE PROPAGATION (Common to ECE, ETCE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives:

1. To converse knowledge on a variety of antenna theory and analysis
2. To present the various conceptual and numerical analysis on various array structure
3. To be conscious of the usage and type of various frequency of antennas.
4. To examine the performance of free space propagation and types of propagation analysis
5. To implement the measurements and experimental analysis.

UNIT I FUNDAMENTALS OF ANTENNA**10 hrs.**

Basic concepts of Retarded Potentials – Antenna Fundamentals and Physics – Radiation from an alternating current element, Half wave Dipole, quarter wave mono pole – Fields, Power radiated and Radiation Resistance – Antenna Parameters: Field Patterns, Gain and Directivity, Effective Length, Effective Aperture, Radiation Resistance, Antenna Terminal (self and mutual) Impedance, Polarization, Beam width, Bandwidth.

UNIT II ANTENNA ARRAYS**10 hrs.**

Arrays of two point sources. Linear arrays of point sources – Direction of Maxima, Direction of Minima and Beam Width – Types of arrays – Broad side, End fire, Colinear, Parasitic arrays. Pattern Multiplication – Binomial arrays.

UNIT III SPECIAL PURPOSE ANTENNAS (QUALITATIVE TREATMENT ONLY)**10 hrs.**

Antennas for low, medium and high frequencies. Effects of earth on radiation patterns of antennas. Practical antennas and methods of excitation. Loop antennas, Traveling Wave antennas – V and rhombic antennas, Folded Dipole, Reflector antennas, Yagi arrays and its applications. Slot radiators, Horn antennas, Parabolic Antenna, Lens Antenna and Wide band antennas – Log-periodic antennas and its applications. Analysis of rectangular and circular microstrip antenna. Smart antennas for mobile communications. Antenna for infrared detectors, Diversity/MIMO.

UNIT IV PROPAGATION**10 hrs.**

Factors involved in the propagation of Radio Waves. The ground wave, Ionosphere and its effects on radio waves. Mechanism of Ionospheric propagation. Refraction and Reflection of sky wave by the ionosphere, Ray paths, skip distance, Maximum usable frequency, Fading of signals. Selective fading – Diversity reception. Space wave propagation, Considerations in space wave propagation. Atmospheric effects in space wave propagation. Super Refraction – Duct Wave Propagation.

UNIT V MEASUREMENTS**10 hrs.**

Measurement of Impedance, Field/Radiation Pattern and gain of antennas, Ionospheric measurements – Vertical incidence measurements of the ionosphere – Relation between oblique and vertical incidence transmission – System Issues – antenna noise, SNR, and link Budget.

Course Outcomes:

On completion of the course, student will be able to–

C01	Classify various types low, medium and high frequency antennas.
C02	Convey the array structure analysis and various parameters
C03	Express the application and types of antennas.
C04	Demonstrate the characters of free space propagation
C05	Explain the fabrication, testing, measurement and accomplish the experimental setup and analysis of parameters.

TEXT BOOKS/ REFERENCE BOOKS:

1. K.D.Prasad, Antennas and Wave Propagation, Satya Prakasan, 3rd Edition, New Delhi, 2001.
2. C A Balanis, Antenna Theory Analysis and Design, 3rd Edition, John Wiley Publishers, 2005.
3. J.D.Kraus, Antennas, 3rd Edition, Mc-Graw Hill book company, 2002.
4. F.E.Terman, Electronic and Radio Engineering, Mc Graw Hill book company, 2004.
5. Rajeshwari Chatterjee, Antenna Theory and Practice, Wiley Eastern Ltd., 1988
6. Robert E.Collin, Antennas and Radio wave propagation, McGraw Hill, 2002
7. Edward C.Jordan, EM Waves and Radiating Systems, PH1, 2003

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 hrs****PART A** : 2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B** : 2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SEEX1010	CONTROL SYSTEMS	L	T	P	Credits	Total Marks
		3	1	0	4	100

Course Objectives

1. To impart knowledge regarding the various types of system and different transfer function analyzing techniques associated with control systems.
2. To analyze the response and error of various types of system in time domain.
3. To understand the stability analysis of frequency domain systems
4. To analyze the open loop system in frequency domain
5. To implement the design of controllers and compensators.

UNIT I SYSTEM CONCEPTS

12 hrs

Types of system – open loop systems, closed loop systems, Basic elements in control system – Mathematical models of physical system: Differential equation- transfer functions of simple electrical networks, Electrical analogous of mechanical translational and Rotational system – D.C and A.C servomotor – Mechanical system- Translational and Rotational system – Block diagram reduction techniques – Signal flow graphs.

UNIT II TIME RESPONSE ANALYSIS OF CONTROL SYSTEMS

10 hrs

Standard test signals -Time response of first and second order system, Time domain- specifications- Generalized error series – Steady state error and error constants.

UNIT III STABILITY OF CONTROL SYSTEM

10 hrs

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Nyquist stability criterion.

UNIT IV FREQUENCY RESPONSE ANALYSIS

10 hrs

Frequency response of the system – Correlation between time and frequency response – Gain and Phase margin – Bode plot.

UNIT V COMPENSATION AND CONTROLLERS

8 hrs

Introduction to compensation networks – Lag, Lead and Lag Lead networks – Compensator Design – P, PI, PID Controllers design using Bode plot.

Course Outcomes:

On completion of the course, student will be able to–

CO1	Understand the types of control systems in different domains
CO2	Analyze the response of any linear time invariant system
CO3	Determine and analyze the stability of the system
CO4	Perform the analysis of the control system in both time and frequency domains
CO5	Design a controller and a compensator in frequency domain

Text / Reference Books

1. I.J.Nagarath and M.Gopal, "Control System Engineering" New Age International (p) Limited Publishers, 2nd edition, 2009.
2. Kausuhio Ogata, "Modern Control Engineering", Prentice Hall of India PVT. Ltd, 5th edition.
3. Richard Dorf, "Modern Control Systems", Pearson Education Ltd, 11th Edition 2009.
4. M.N. Bandyopadhyaj, "Control Engineering, Theory and Practice" PHI, 4th print, 2006.
5. N.K.Sinha, "Control Systems", New Age International Private Limited Publishers, 3rd Edition, 1998, reprint 2004.
6. A.Nagoorkani, "Control System", RBA Publications, 3rd edition, reprint 2012.
7. U.A.Bakshi and S.C.Goyal, "Control System Engineering", Technical Publication, 2nd Revised reprint 2007.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 hrs****PART A** : 2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B** : 2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SECX1007	ANALOG INTEGRATED CIRCUITS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To introduce the concepts of fabrication of Integrated circuit.
2. To study the OP-AMP and its applications.
3. To acquire the knowledge about the filters, oscillators and converters.
4. To study the basic principles of PLL and Timer Circuit
5. To be aware of the concept of Special function ICs

UNIT I INTRODUCTION TO OPERATIONAL AMPLIFIERS

10 hrs

Introduction to IC fabrication steps- Differential amplifier -Current sources-Building blocks for operational amplifier Monolithic OP-AMP – Ideal operational amplifier – DC and AC Characteristics Input offset voltage- Input bias current Input offset current- Total output offset voltage- Thermal drift- Slew rate- CMRR -Specifications of typical op- amp(741) – Open loop and closed loop configurations.

UNIT II BASIC OP-AMP APPLICATIONS

10 hrs

Inverting amplifier- Non-inverting amplifier- Voltage follower- Summing and differential amplifier - Voltage to current – Current to voltage converters- Integrator- Differentiator- Logarithmic and Anti logarithmic amplifiers-Comparator and Schmitt trigger- Frequency response and compensation.

UNIT III FILTERS AND OSCILLATORS

10 hrs

First order and Second order Butterworth filters- low pass, high pass, band pass and band reject filters -RC phase shift, Wein's bridge oscillator- Astable and Monostable multivibrator-Precision half wave and full wave rectifiers.

UNIT IV A/D AND D/A CONVERTERS

10 hrs

Sample and Hold circuit – Digital to analog converters: R-2R ladder network and Binary weighted – Characteristics of D/A converters – Analog to digital converters: Flash converter – Successive approximation converter – Dual slope and Oversampling ADCs – Delta Sigma ADC.

UNIT V SPECIAL FUNCTION ICs

10 hrs

Analog Multiplier IC AD 533- Phase Locked Loop IC 565– Block schematic – Lock range and capture range – Applications of PLL: FM demodulator and Frequency synthesizer- VCO IC LM 566 – Timer IC LM 555 and its applications :Astable and Monostable multivibrator – PWM modulator- Positive and Negative Voltage regulators.

Course Outcomes

On completion of the course, student will be able to

CO1	Enhance the knowledge of fabrication steps for integrated circuits
CO2	Design the Active filters using Op- Amp for the given specifications and to describe the concept of CMRR and AC - DC characteristics of operational amplifier.
CO3	Relate the OPAMP for linear and non linear applications including comparators and wave form generators.
CO4	Design the Active filters using Op- Amp for the given specifications.
CO5	Analyze ADC and DAC for Real time Implementation

TEXT / REFERENCE BOOKS:

1. Grey and Meyer, Analysis and Design of Analog Integrated Circuits, 4th Edition, Wiley International, 2001.
2. Michael Jacob, Applications and Design with Analog Integrated Circuits, 2nd Edition, Prentice Hall of India, 1993.
3. RamakantA.Gayakwad, OP-AMP and Linear ICs, 4th Edition, Prentice Hall / Pearson Education, 1994.
4. William D.Stanely, Operational Amplifiers with Linear Integrated Circuits, 4th Edition, Pearson Education, 2004.
5. Sergio Franco, Design with operational amplifiers and analog integrated circuits, 3rd Edition, McGraw-Hill, 1997.
6. D.RoyChoudary, Shail Jain, Linear Integrated Circuits, New Age International Pvt. Ltd., 2000.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3hrs****PART A :** 2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B :** 2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SECX4008	ANALOG INTEGRATED CIRCUITS LAB (For ECE)	L	T	P	Credits	Total Marks
		0	0	4	2	100

Course objectives:

- To enable the students to design and testing of analog integrated circuits
- To expose the students to a variety of practical circuits using various analog ICs.

SUGGESTED LIST OF EXPERIMENTS

1. Study of IC 741, IC 555 and PLL
2. Measurement of Op amp parameters
3. Inverting, Non Inverting amplifier & its applications (Summer, differentiator, Integrator, multiplier)
4. Precision Rectifiers (HW & FW)
5. Filters (LPF & HPF)
6. A/D & D/A Converters
7. RC Oscillator
8. Multivibrator (Astable & Monostable)
9. Schmitt Trigger
10. PLL as voltage multiplier
11. Multivibrator using IC 555
12. Comparators
13. Waveform generators
14. Instrumentation Amplifier

SECX4009	COMMUNICATION ENGINEERING LAB (For ECE)	L	T	P	Credits	Total Marks
		0	0	4	2	100

course objectives:

- To get the basic knowledge of the communication system.
- To Implement AM & FM modulation and demodulation
- To understand the basic if sampling and reconstruction of signal.
- To simulate the design experiment of digital modulation schemes.

SUGGESTED LIST OF EXPERIMENTS

1. Amplitude modulation & determine its modulation factor.
2. Amplitude demodulation by linear diode detector.
3. Frequency modulation and determine its modulation factor.
4. Ratio detector as FM Demodulator
5. Pulse amplitude modulator using IC 555
6. Sampling and reconstruction of Pulse Amplitude modulation system.
7. Delta modulation and demodulation technique.
8. Pulse Duration Modulation using IC 555
9. Generation of Amplitude Shift Keying
10. Phase Shift keying modulation and demodulation.
11. Frequency Shift keying modulation and demodulation.
12. Frequency Division Multiplexing.
13. Balanced modulator circuit using MC1496
14. Frequency response characteristics of IF amplifier
15. Construction and testing of a mixer stage
16. Pre-emphasis & De-emphasis

COURSE OUTCOMES:

At the end of the course student will be able to

CO1.	Simulate & validate the various functional modules of a communication system
CO2.	Demonstrate their knowledge in base band signaling schemes through implementation of digital modulation schemes
CO3.	Ability to design a Digital modulation system as per needs and specification.
CO4.	Get familiarize with the basics of noise theory and performance of various receivers.
CO5.	Acquire the knowledge about the sampling process and pulse modulation and Identify and compare different pulse modulation techniques

SECX1031	COMMUNICATION SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To impart knowledge on various types of Telephone and Telephone Systems.
2. To describe various types of IEEE standards for wireless communication.
3. To discuss the principles of Television and Digital Television.
4. To understand the basics of Satellite communication.
5. To analyze the principles of RADAR communication and range equation.

UNIT I LINE COMMUNICATION

10 hrs

Telephones – Standard Telephone and local loop – Electronics Telephone – Cordless Telephone – Telephone System – Telephone Facsimile – Fax Machine Operation – Cellular Telephone system – Digital cellular Telephone system – Paging System – ISDN.

UNIT II WIRELESS COMMUNICATION

8 hrs

Review of IEEE standards – IR – Ultrasonic – RF – Bluetooth – WiFi – ZIGBEE Protocol.

UNIT III TELEVISION

9 hrs

Basic Principles – Scanning – Camera tubes – band width consideration – generation of composite video signals – monochrome and color transmitter – Picture tubes – receivers – Digital TV – HDTV – Flat screen TV- Set top box.

UNIT IV SATELLITE COMMUNICATION

9 hrs

Orbit dynamics – Satellite system – System calculation – satellite sub system and earth station sub system – stabilization – noise in satellite communication system – multiple access method – TDMA – FDMA. CDMA system

UNIT V RADARS

9 hrs

Radar block diagram and operation – range equation – Doppler effect CW radar – FM CW radar – MTI radar – Pulsed radar – tracking – detection of radar signals in noise – correlation detection – CFAR receiver and pulse compression.

Course Outcomes

On completion of the course, student will be able to–

CO1	Classify various types of Telephone systems and explain its applications.
CO2	Explain and review different types of IEEE standards for wireless communication.
CO3	Illustrate Television functions and principles.
CO4	Evaluate the basic principles of Satellite and RADAR communication
CO5	Design and construct robust, fault tolerant circuits for Satellite, RADAR and Wireless communication

TEXT / REFERENCE BOOKS:

1. Dennis Roody and John Coolen, Electronic Communications, 4th edition, Prentice Hall of India, 2002.
2. George Kennedy, Electronic Communication Systems, Mc Graw Hill, 1984.
3. Merrill I Skolnik, Introduction to Radar Systems, 3rd edition, Mc Graw Hill 2002.
4. R.Gulati, Monochrome and colour television, 2nd edition, New age international 2005.
5. Louis. E. Frenzel, Communication Electronics Principles and applications", 3rd edition, Tata Mc.Graw Hill, 2002

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 hrs****PART A :** 2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B :** 2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SCSX1015	DATABASE MANAGEMENT SYSTEM (Common to ECE, EEE, BIOINFO)	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives:

- 1.To master the basic concepts of databases.
- 2.To be familiar with commercial databases(Oracle ,MySql)
- 3.To be familiar with relational database theory and to be able to write relational algebraic expressions
- 4.To be familiar with database storage and access techniques
- 5.To master query processing ,optimization and evaluation techniques

UNIT I INTRODUCTION**10 hrs.**

Data Bases- Need- Concepts- Architecture- data Independence. Datamodeling: Entity-Relationship model: ER diagram-Aggregation-Weak Entity Sets, Mapping ER model to other data models.

UNIT II RELATIONAL MODEL**10 hrs.**

Concepts- Integrity constraints, Relational Algebra, SQL Queries-data definition, manipulation, select statements, views in SQL

UNIT III RELATIONAL CALCULUS**10 hrs.**

Tuple Relational calculus, Domain relational calculus, QBE language, Query processing and Query optimization.

UNIT IV RELATIONAL DATABASE DESIGN**10 hrs.**

Armstrong's Axioms-Design issues Decomposition –Normalization using Functional dependencies- Multi valued dependencies –join dependencies –Domain key normal form.

UNIT V DATABASE MODELS**10 hrs.**

An overview of network model and hierarchical model object oriented data model- Objects definition and manipulation language-Object oriented databases- Object relational database.

Course Outcomes

On completion of the course, student will be able to–

CO1	Perform logical design of databases using ER model
CO2	Construct queries using SQL
CO3	Perform query evaluation and query optimization
CO4	Explain basic challenges of query processing and concurrency control
CO5	Understand database storage and access structures , file organization and indexing methods

TEXT/REFERENCE BOOKS:

1. R.Elmasri and S.B Navethe, “Fundamental of Data base systems” 2nd edition, The Benjamin/cumming Pub.co, 1994.
2. A.Silbercharts, H.F Korth&S.Sundharsan, “Data Base System Concepts“, 3rd edition, MGH 1997.
3. C.J.Data, “An Data Base System “, Galgotia, 1985.
4. C.M Ricardo, ” Data Base System Concepts Principles, Design and implementation “ Macmillan, 1990.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks :80****Exam Duration : 3hrs****PART A** :2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B** :2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SECX1032	MICROPROCESSOR INTERFACING AND APPLICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To acquire knowledge different microprocessors.
2. To understand the timing diagram, interrupts
3. To study the addressing modes and classification of instruction set.
4. To develop algorithms and write assembly language programs.
5. To understand how to interface the microprocessor to peripherals.
6. To design and develop microprocessor based systems

UNIT I INTRODUCTION TO 8085

10 hrs

Intel 8085 Microprocessor architecture – signals – Addressing modes – Instruction classification
Instruction set— Timing diagram – ALP format – Programming 8085 – 8-bit and 12-bit Operation
including stack-subroutine – Introduction to interrupt handling and related instructions –
comparison of 8085 with z80 and 6800.

UNIT II PERIPHERALICS

10 hrs

PPI 8255 – Programmable keyboard display –Interface 8279 – Programmable interrupt controller 8259 –
Programmable DMA controller 8257 –USART 8251 –Programmable interval timer 8253.

UNIT III INTERFACING WITH 8085/8086

10 hrs

Stepper motor control – Temperature control – ADC – DAC – 7-segment display – Comparison of
8085 with Z 80 & 6800 – RS 232-RS 422-RS 485 – Alphanumeric LCD display.

UNIT IV 12 BIT PROCESSOR

10 hrs

Architecture of 8086 – signals – addressing modes – minimum & maximum mode of operation –
Instruction set –

Assembly language programs in 8086 – 8284 clock driver

UNIT V ADVANCED PROCESSORS

10 hrs

Review of Processor and its types – 80286 – 80386 – 80486 – Introduction to Pentium family –
MMX architecture and instruction set – Core 2 duo and Core 2 Quad Processor.

Course Outcomes:

On completion of the course, student will be able to–

CO1	Get the basic knowledge about the different microprocessors.
CO2	Understand the execution of instructions.
CO3	Understand the instruction sets and addressing modes.
CO4	Develop algorithms and write assembly language programs
CO5	Interface the microprocessors to peripherals

TEXT / REFERENCE BOOKS:

1. Ramesh Goankar, Microprocessor Architecture Programming and Applications with 8085 / 8088, 5th Edition, Penram International Publishing.
2. A.K.Ray and Bhurchandi, Advanced Microprocessor, 1st edition, TMH Publication.
3. DouglasV.Hall, "Microprocessors and Digital System", 2nd Edition, Mcgraw Hill, 1983.
4. A.K.Ray and K.M.Bhurchandi, "Advanced microprocessors and Peripherals- Architecture, Programming and Interfacing", TMH, 2002.
5. P.K.Ghosh and P.R.Sridhar, "Introduction to Microprocessors for Engineers and Scientist", 2nd Edition, PHI, 1991

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3hrs****PART A :** 2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B :** 2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SECX1033	DIGITAL COMMUNICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To understand the basic building blocks of digital communication systems.
2. To get introduced to various encoding and digital modulation techniques
3. To understand the principles of error correction codes and its impact on system performance
4. To understand the importance and principles of synchronization schemes used in digital communication systems.
5. To get introduced to concepts of spread spectrum communication.

UNIT I SAMPLING AND QUANTIZATION

9 hrs

Sampling process – Aliasing - PAM- Natural Sampling-Flat Sampling-PPM- PWM–Bandwidth –Noise trade off– PCM- Noise considerations in PCM- Quantization-Delta modulation –Linear prediction – differential pulse code modulation – Adaptive Delta Modulation

UNIT II BASEBAND PULSE TRANSMISSION

9 hrs

Matched Filter- Error Rate due to noise –Intersymbol Interference- Nyquist's criterion for Distortionless Base band Binary Transmission- Correlative level coding – Baseband M-ary PAM transmission – Adaptive Equalization – Eye patterns

UNIT III DIGITAL MODULATION TECHNIQUES

9 hrs

Introduction – ASK- FSK – PSK- coherent modulation techniques-BFSK-BPSK-signal space diagram-probability of error-Coherent Quadrature modulation techniques- QPSK-MSK-signal space diagram-probability of error- Non coherent modulation techniques-M-ary modulation techniques-Carrier Synchronization- Timing Synchronization

UNIT IV ERROR CONTROL CODING

9 hrs

Discrete memoryless channels – Linear block codes - Cyclic codes - Convolutional codes – Maximum likelihood decoding of convolutional codes-Viterbi Algorithm, Trellis coded Modulation, Turbo codes.

UNIT V SPREAD SPECTRUM MODULATION

9 hrs

Pseudo- noise sequences – a notion of spread spectrum – Direct sequence spread spectrum with coherent binary phase shift keying – Signal space Dimensionality and processing gain – Probability of error – Frequency –hop spread spectrum.

Course Outcomes

On completion of the course, student will be able to–

CO1	To understand the working of digital communication systems and describe different source encoding schemes.
CO2	To remember and apply matched filter receiver or correlation receiver for distortion free reception of baseband binary signals.
CO3	To evaluate the performance of digital communication systems with different modulation schemes in the presence of noise.
CO4	To design and analyze the performance of digital communications system in a noisy environment with different error correction codes.
CO5	To design, model and evaluate the performance of spread spectrum based digital communication systems.

TEXT / REFERENCE BOOKS:

1. Simon Haykins, "Communication Systems" John Wiley, 5th Edition, March 2009.
2. Taub. HDL Schilling, G Saha, " Principles of Communication"3rd edition,2007.
3. John G. Proakis, Masoud Salehi, "Digital Communication", McGraw Hill, 5th edition,2007.
4. Bernard Sklar, "Digital Communication, Fundamentals and Application", Pearson Education Asia, 2nd Edition, 2001.
5. Taub, Schilling, G Saha, " Principles of Communication"3/e,2007.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 hrs****PART A :**2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B :**2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SECX4010	MICROPROCESSOR AND MICROCONTROLLER LAB	AL	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVES

1. To understand the operation of 8085, 8086 Microprocessor & Microcontroller
2. To develop algorithms and write assembly language programs
3. To provide knowledge to solve real time issues using Microprocessor and Microcontroller.

LIST OF EXPERIMENTS**Programs using 8085 & 8086 Processors**

1. Programs for 8 & 16 bit multi byte addition and subtraction
2. Programs for 8 & 16 bit multiplication and division
3. Programs for Sorting & Searching
4. Programs for String manipulation operation
5. Programs for Table processing, Code conversions

Interfacing experiments

- (a) Programming with 8251
- (b) Programming with 8259
- (c) Programming with 8257
- (d) Programming with 8253 (all modes)
- (e) Programming with 8279
- (f) Programming with 8255 (all modes)
- (g) Interfacing seven segment display unit
- (h) Interfacing stepper motor
- (i) Interfacing traffic light system
- (j) Digital IC testing

II. Programs Using Microcontroller

1. FHP motor interface with 8051
2. Conveyor arrangement with 8051
3. Temperature controller with 8051
4. Programming using Arithmetic and Logical instructions of 8051
5. Programming using bit Manipulation instruction of 8051
6. Interfacing data acquisition IC with 8051
7. ADC / DAC with 8051

III. Logic Analyzer**Course Outcomes:**

On completion of the course, student will be able to

CO1	Develop algorithms for assembly programs.
CO2	Write assembly language programs for Microprocessor and Microcontroller.
CO3	Understand and implement various real time applications
CO4	Understand how peripheral chips are interfaced to the microprocessors and microcontrollers.
CO5	Design and implement 8051 Microcontroller based products.

SEC4065	DIGITAL SIGNAL PROCESSING LAB (For ECE)	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVE

1. To provide knowledge for understanding of digital signal processing through hands-on experience that is sufficient to enable them to apply DSP to real-world problems.
2. To understand the process of convolution, correlation, DFT, IDFT, Signal smoothing, filtering of long duration signals, and Spectral analysis of signals.

SUGGESTED LIST OF EXPERIMENTS

1. Study of ADSP 21XX & TMS 320 C XX processor
2. Generation of Periodic Signals
3. Generation of Non Periodic Signals
4. Sampling
5. Modulation and Demodulation using Matlab
6. Computation of Z Transform & Inverse Z transform
7. Computation of Impulse & System Response
8. Design of FIR filters using Windowing Techniques
9. Design of IIR filters using Bilinear Transformation
10. Spectral Analysis using Matlab
11. Implementation of FFT using DIT and DIF algorithm
12. Convolution (Linear and Circular)
13. Correlation (Auto & Cross)
14. Frequency response of first and second order systems
15. Fast Fourier Transform (FFT), Inverse Fast Fourier Transform (IFFT)

Course Outcomes:

On completion of the course, student will be able to

CO1	Understand the handling of discrete signals using MATLAB
CO2	Learn to represent real world signals in digital format and understand transform-domain representation of the signals
CO3	Analyse the spectral parameters of window functions.
CO4	Design of IIR and FIR filters using butterworth and chebyshev approximation.
CO5	Perform the convolution and correlation of two signals and design the signal processing algorithm using MATLAB.

SECX1034	TLECOMMUNICATION SWITCHING SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

To acquaint the students with the architecture, theory and operation of telecommunication systems and their switching concepts.

UNIT I

10 hrs

Switching system functions – stronger switching system – cross bar exchange – SPC exchange – Message switching – circuits switching – Telephone handset – four wire concept – Hybrid circuit – Echo suppressor and cancellors – PCM coders – Modems and relays – Telecommunication standard.

UNIT II

10 hrs

Time switching – space switching – STS and TST switching –digital switching system hardware – principles of switching system software organizational processing software – switching in networked environment – ISDN.

UNIT III

10 hrs

Channel associated signaling – Common channel signaling - SS7 protocol - traffic – grade of service –
Modeling switching system –Blocking models and relay system

UNIT IV

10 hrs

Subscriber loop – DSL – ADSL – FDM and TDM – PCM multiplex group – PDSH, SDH / SONET – cross talk – line equalizations – adaptive equalizers – single stage network – two, three, four stage networks – network synchronization.

UNIT V

10 hrs

Data transmission in PSTN – packet switching – connection oriented and connectionless protocols – ISO – OSI architecture – TCP/IP and Internet – multiple access techniques – satellite based data networks – principles of ATM networks-IP Switching-Applications.

Course Outcomes

On completion of the course, student will be able to–

CO1	Understand the operational characteristics of switching techniques.
CO2	Classify and recognize suitable switching techniques for networked environment.
CO3	Interpret the operations of various signaling techniques and modeling the switching system
CO4	Examine the performance of various components of a switching system
CO5	Investigate the conventional switching techniques for internet, satellite based networks, ATM, etc. and to develop modified switching techniques for required Grade of Service

TEXT / REFERENCE BOOKS:

1. Flood. J.E., Telecommunication switching, Traffic and Networks, Pearson Education Ltd, New Delhi, 2006.
2. Syed R Ali, Digital switching systems, McGraw Hill, New York 2002.
3. Viswanathan T, Telecommunication switching systems and networks, PHI 2006.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 hrs****PART A :** 2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B :** 2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SECX1035	CELLULAR AND MOBILE COMMUNICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To understand the basic cellular system concepts.
2. To have an insight into the various generation used in mobile communication.
3. To understand the multiple access techniques and interference education techniques in mobile communication.

UNIT I

10 hrs

Introduction to Cellular Mobile System, Performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells, Analog and Digital Cellular systems, General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a omni directional Antenna system, Cell splitting, consideration of the components of Cellular system

UNIT II

10 hrs

Introduction to Co-Channel Interference, real time Co-Channel interference, Co-Channel measurement, design of Antenna system, Antenna parameters and their effects, diversity receiver, non-co channel interference-different types, Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long distance propagation antenna height gain, form of a point to point model

UNIT III

10 hrs

Sum and difference patterns and their synthesis, omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas, Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non fixed channel assignment, Handoff, dropped calls and cell splitting, types of handoff, handoff invitation, delaying handoff, forced handoff, mobile assigned handoff. Intersystem handoff, cell splitting, micro cells, vehicle locating methods, dropped call rates and their evaluation.

UNIT IV

10 hrs

Second generation and Third generation Wireless Networks and Standards, WLL, Bluetooth, GSM, IS-95, DECT, GSM architecture, GSM channels, multiplex access scheme, TDMA, CDMA.

UNIT V

10 hrs

Intelligent Cell Concept, Advanced Intelligent Network, SS7 Network and ISDN for AIN, AIN for Mobile communication, Asynchronous Transfer Mode Technology, Future Public Land Mobile Telecommunication System, Wireless Information Superhighway.

Course Outcomes

On completion of the course, student will be able to–

C01	Understand the basics and characteristics of cellular systems
C02	Report the impact of terrain, channel characteristics on transmitted signal.
C03	Demonstrate the solutions to different hand off problems
C04	Appraise the significance of standards in 2G and 3G wireless techniques
C05	Develop suitable communication protocol architecture for wireless communication

TEXT / REFERENCE BOOKS:

1. W.C.Y. Lee, "Mobile Cellular Telecommunications", 2nd Edition, Tata McGraw Hill, 2006.
2. Gordon L. Stuber, "Principles of Mobile Communications", 2nd Edition, Springer International, 2007.
3. Theodore. S. Rapoport, "Wireless Communications", 3rd Edition, Pearson Education, 2003.
4. Lee, "Wireless and Mobile Communications", 3rd Edition, McGraw Hill, 2006.
Jon W. Mark and WeihuaZhqung, "Wireless Communication and Networking", PHI, 2005.
5. R. Blake, "Wireless Communication Technology", Thompson Asia Pvt. Ltd., 2004.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3hrs****PART A** :2 Questions from each unit, each carrying 2 marks. No choice

20 Marks

PART B :2 Questions from each unit with internal choice, each carrying 12 marks

60 Marks

SECX1036	COMPUTER COMMUNICATION	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To understand the basic concepts of communication between computers.
2. To understand the functioning of all layers in OSI model.
3. To understand the working of various protocols at all layers of network.

UNIT I INTRODUCTION.

10 hrs

Introduction: Communication model, Network H/W, Network S/W, OSI reference Model, TCP/IP protocol suite, Network services and Interfaces, Network Topologies, Networks example, Network Standardization, World Wide Web, Multimedia applications.

UNIT II NETWORKS, PHYSICAL AND DATA LINK LAYERS.

10 hrs

Point to Point Networks, Routing and Flow Control, Packet Communication Technology, Packet Broadcasting, Terrestrial Networks. Physical Layer: Guided transmission media – Magnetic media, Twisted Pair, coaxial cable, fiber optic network. Data Link Layer: Design Issues, Error detection and correction, Elementary Data Link Protocols, Sliding Window Protocols, Protocol Verification, Example Data Link protocols.

UNIT III MEDIUM ACCESS SUB LAYER AND TRANSPORT PROTOCOL

10 hrs

The Medium Access Sub Layer : The channel allocation problem, Multiple access Protocols, Ethernet, Wireless LANs, Broadband Wireless, Bluetooth, Data Link Layer Switching. The Network Layer: Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, Quality of Service. The Transport Protocol: The Transport Service, Elements of transport protocol, Performance Issues.

UNIT IV APPLICATION LAYER AND NETWORK SECURITY

10 hrs

The Application Layer: DNS-(Domain Name System), Electronic Mail, World Wide Web Multimedia. Network Security: Cryptography, Symmetric_key Algorithms, Public-Key Algorithms, Digital Signatures, Management of public keys

UNIT V COMMUNICATION SECURITY

10 hrs

Communication Security: Authentications Protocols, E-mail Security, Web security, Social Issues, SDL based protocol verification and validation, Internet protocol, SDL based interoperability testing of CSMA/CD and CSMA/CA protocol using Bridge, Scalability testing-Applications.

Course Outcomes

On completion of the course, student will be able to–

CO1	Analyze the working of various OSI model
CO2	Have a thorough knowledge in network topology, its pros and cons
CO3	Apply various modes of communication
CO4	Apply novel methodology in protocols at various layers
CO5	Address security issues

TEXT / REFERENCE BOOKS:

1. Michael A. Gallo, William Hancock. M, Computer Communications and Networking Technologies, BROOKS/COLE/2001
2. Richard Lai and Jirachiefpattana, "Communication Protocol Specification and Verification", Kluwer Publishers, Boston, 1998.
3. Pallapa Venkataram and Sunilkumar S. Manvi, "Communication protocol Engineering", PHI Learning, 2008
4. Andrew S Tanenbaum, Computer Networks, 4th Edition. Pearson Education/PHI/2008
5. Behrouz A. Forouzan, Data Communications and Networking, Fourth Edition, Mc GrawHill HIGHER Education 2007.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 hrs****PART A :** 2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B :** 2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SECX1023	PROGRAMMING IN HDL	L	T	P	Credits	Total Marks
		3	0	0	3	100

course objectives

1. To focus on the basic concept of VHDL and Verilog HDL
2. To Introduce the style of modeling in VHDL and Verilog HDL
3. To focus advanced features of Verilog HDL
4. To outline the formal procedures for testing and verification of HDL
5. To introduce the design of switch level modeling and high level architecture

UNIT I INTRODUCTION TO VHDL**10 hrs**

Digital system design process – Levels of Abstraction – Language elements of VHDL- Operators-Data Types – Signal assignments – Inertial delay mechanism – Transport delay mechanism – Concurrent and Sequential assignments – Delta delay.

UNIT II STYLES OF MODELING**10 hrs**

Process statement – Wait statement – If statement - Loop statement - Assertion statement – Data flow modeling– Concurrent Signal Assignment statement - Structural modeling – Examples – Component declaration – Component Instantiation – Generate statement – Guarded signals.

UNIT III ADVANCED FEATURES**10 hrs**

Generics – Configurations – Configuration Specification – Configuration Declaration - Subprograms – Subprogram Overloading – Operator Overloading - Package declaration and package body – Design Libraries – State Machine Modeling – Moore FSM, Mealy FSM.

UNIT IV VERILOG HDL**10 hrs**

Verilog as HDL – Levels for design description – Language elements – Data Types – Operators – Module structure – Gate primitives – Timing controls – Procedural and Conditional assignments – Data flow Modeling – Structural Modeling – examples.

UNIT V PROGRAMMING USING VERILOG**10 hrs**

Realization of SM charts – Xilinx 3000 series FPGAs – Altera Complex Programmable Logic devices – Static RAM Memory – Interfacing Memory to a Microprocessor Bus – UART design – Design of Microcontroller CPU.

Course Outcomes

On completion of the course, student will be able to–

CO1	Interpret the basic logic designs.
CO2	Understanding the various modelling to interpret digital system design.
CO3	Analyze the synthesis report.
CO4	Built a RTL schematic and analyze the parameters.
CO5	Determine the performance of combinational and sequential circuits and evaluate the efficiency of Digital design in various applications.

TEXT/REFERENCE BOOKS:

1. J.Bhaskar ,“A VHDL primer”,3rd edition 2004, Prentice Hall of India Limited.
2. J.Bhaskar, “A Verilog HDL Primer”, 3rd edition 2004, Prentice Hall of India Limited.
3. Charles H,Roth ,“Digital system design using VHDL” , 2nd Edition, PWS publishing co., 2005.
4. ZainalabedinNavabi, “VHDL analysis and modeling of digital systems”, 2ndEdition, MGH, 2004.
5. Michael D.Ciletti, “Advanced Digital design with Verilog HDL” , 2nd Edition, PHI Ltd, 2005.
6. T.R.Padmanabhan&Bala Tripura sundari, “Design through Verilog HDL” , WSE2004 IEEE press.
7. Michael D.Ciletti “Advanced Digital design with Verilog HDL” , PHI, 2005.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 hrs****PART A** :2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B** :2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SECX4012	HARDWARE DESCRIPTION LANGUAGE LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

Course Objectives:

1. To Give a Introduction on Digital logic systems.
2. To explain how combinational circuits are being used.
3. To explain how Sequential circuits are being used.
4. To explain the importance of memories

LIST OF EXPERIMENTS:

- | | |
|------------------------------------|--|
| 1. Design of all gates | 2. Design of subtractors |
| 3. Design of ALU | adders, |
| 5. Design of Encoder and Decoder | 4. Design of Comparator |
| 7. Design of FF | 6. Design of Multiplexer and Demultiplexer |
| 9. Magnitude Comparator | 8. Code converters |
| 11. Design of Synchronous Counters | 10. Design of registers using latches and flip flops |
| | 12. Design of Shift registers |

Course Outcomes

On completion of the course, student will be able to–

C01	Understand the timing effects of hardware mapping and circuit practices
C02	Learn detailed difference between procedural programming and hardware description languages
C03	Analyse synthesizable code describing basic logic elements a. Combinatorial logic. b. Sequential logic.
C04	Design basic logic pipelined machines, digital circuits using a hardware description language and synthesis
C05	Perform synthesizable working circuits using programmable logic.

SECX1037	MICROWAVE ENGINEERING	L	T	P	Credits	Total Marks
		0	0	3	3	100

course objectives

1. Analyze transmission-line circuits at microwave frequencies and Perform Scattering parameter analysis of microwave systems and assess the impact of microwave component performances on overall system performance.
2. Describe the operation and analyze the performance of basic microwave components and to Design basic microwave Components
3. Analyze Assess qualitatively and quantitatively the role of microwave components in the application areas of MIC, MEMS, wireless systems and UWB systems

UNIT I INTRODUCTION**10 hrs.**

Microwave spectrum and bands-characteristics of microwaves-a typical microwave system. Traditional, industrial and biomedical applications of microwaves. Microwave hazards.S-matrix – significance, formulation and properties.S-matrix representation of a multi port network, S-matrix of a two port network with mismatched load.

UNIT II MICROWAVE COMPONENTS**10 hrs.**

Waveguide Attenuators- Resistive card, Rotary Vane types. Waveguide Phase Shifters : Dielectric, Rotary Vane types. Waveguide Multi port Junctions- E plane and H plane Tees, Magic Tee, Hybrid Ring. Directional Couplers- 2 hole, Bethe hole types. Ferrites-Composition and characteristics, Faraday Rotation. Ferrite components: Gyrator, Isolator, Circulator. S-matrix calculations for 2 port junction, E & H plane Tees, Magic Tee, Directional Coupler, Circulator and Isolator

UNIT III MICROWAVE TUBES**10 hrs.**

Microwave tubes: O-type – Two cavity Klystrons: structure, resonant cavities, velocity modulation and Applegate diagram, bunching process. Reflex Klystrons- structure, modes and o/p characteristics, electronic and mechanical tuning.M-type – cross-field effects, Magnetrons-types, 8-cavity Cylindrical Travelling Wave Magnetron- Hull cut-off and Hartree conditions, modes of resonance and PI-mode operation, o/p characteristics. HELIX TWT- types and characteristics of slow wave structures, structure of TWT and amplification process (qualitative treatment), Backward Wave Oscillators

UNIT IV MICROWAVE SEMICONDUCTOR DEVICES AND INTEGRATED CIRCUITS**10 hrs.**

Avalanche Transit Time Devices- principle of operation and characteristics of IMPATT and TRAPATT diodes, Point Contact Diodes, Schottky Barrier Diodes, Parametric Devices, Detectors and Mixers.Monolithic Microwave Integrated Circuits (MMIC), MIC materials- substrate, conductors and dielectric materials. Types of MICs, hybrid MICs(HMIC).

UNIT V MICROWAVE ANTENNAS AND MEASUREMENTS**10 hrs.**

Horn antenna and its types, micro strip and patch antennas.Network Analyzer, Measurement

Course Outcomes

On completion of the course, student will be able to–

C01	Know about the microwave frequencies and the waveguides that are used in communication.
C02	Understand the operation and working of the various tubes or sources for the transmission of the microwave frequencies.
C03	Understand and analyze various semiconductor devices. Apply Smith chart use for solution of transmission line problems and impedance matching.
C04	Analyze the difference between the conventional tubes and the microwave tubes for the transmission of the EM waves.
C05	Acquire knowledge about the measurements to be done at microwaves.

TEXT BOOKS / REFERENCE BOOKS:

1. Samual Y. Liao, "Microwave Devices and Circuits", PHI, 3rd Edition, 1994.
2. Collin R.E., "Foundation of Microwave Engineering", McGraw Hill, 2nd Edition, 1992.
3. Microwave Principles – Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, CBS Publishers and Distributors, New Delhi, 2004.
4. Reich J. et al, "Microwaves", East West Press, 1978.
5. Gupta K.C., "Microwaves", Wiley Eastern Ltd., 1995.
6. Peter A. Rizzi, "Microwave Engineering – Passive Circuits", PHI Publications.
7. Chatterjee R., "Elements of Microwave Engineering", Affiliated East-West Press Pvt. Ltd.
8. Sisodia M.L and Raghuvanshi G.S., "Microwave Circuits and Passive Devices", Wiley Eastern Ltd., 1995.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 hrs

PART A : 2 Questions from each unit, each carrying 2 marks. No choice

20 Marks

PART B : 2 Questions from each unit with internal choice, each carrying 12 marks

60 Marks

SECX1038	OPTICAL COMMUNICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To introduce the principle of light propagation through optical fibers.
2. To understand signal distortion mechanisms in the fiber.
3. To introduce optical transmitters and receivers for fiber /free space links and the fiber optic couplers, connectors involved.
4. To introduce optical network concepts and components involved and its Applications.

UNIT I

9 hrs

Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod. Rays and Modes. Different types of optical fibers, Modal analysis of a step index fiber, Linearly Polarized Modes, Single- mode fibers and Graded- Index Fiber.

UNIT II

9 hrs

Attenuation- Absorption, Scattering Losses, Bending Losses, Core and Cladding Losses. Signal distortion in Optical waveguides- Material Dispersion, Waveguide Dispersion. Optical sources - Semiconductor Device Fabrication, LED and LASER diode - Principles of operation, concepts of line width, phase noise, switching and modulation characteristics.

UNIT III

9 hrs

Optical detectors – pn detector, pin detector, avalanche photodiode - Principles of operation, concepts of responsivity, sensitivity and quantum efficiency, noise in detection. Multichannel Transmission Technique- Multichannel Frequency Modulation, Subcarrier multiplexing. WDM Concepts and Components.

UNIT IV

9 hrs

Basic concepts, semiconductor amplifier, Erbium-Doped Fiber Amplifier, Raman amplifier, Brillouin amplifier - principles of operation, amplifier noise, signal to noise ratio, gain, gain bandwidth, gain and noise dependencies, intermodulation effects, saturation induced crosstalk, wavelength range of operation.

UNIT V

9 hrs

Optical networks: SONET/SDH, ATM, IP, Wavelength routed networks, soliton communication system, fiber soliton, Soliton based communication system design, High capacity and WDM soliton system. Limitations, Post and Pre- compensation techniques, Equalizing filters, fiber based gratings, Broad band compensation-Applications.

TEXT / REFERENCE BOOKS:

1. Keiser. G, "Optical fiber communications", 4th Edition Tata McGraw-Hill, New Delhi, 2008.
2. Agrawal. G.P, "Fiber-Optic Communication Systems" 3rd Edition John Wiley & Sons, 2002.
3. John Gowar, "Optical Communication Systems", 2nd Edition Prentice Hall, 1993.
4. Franz & Jain, "Optical communication, Systems and Components", Narosa Publications, New Delhi, 2000.
5. Karminvov & T. Li "Optical Fibre Telecommunications", Vol A & B, Academic Press, 2002.

Course Outcomes

C01	Recall the basic optical laws and recognizing the types of optical fiber cables. Identifying the signal impairments in optical systems
C02	Exemplify the characteristics of optical sources and detectors. Summarize the conversion of light energy into electrical energy and vice versa.
C03	Implementing the transmission techniques and concepts in designing electrical engineering problems
C04	Select an appropriate amplifier by critically evaluating its noise parameters.
C05	Create the opportunity to design optical communication system for industrial applications

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 hrs****PART A :** 2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B :** 2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SECX4013	MICROWAVE, OPTICAL AND SIMULATION LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

Course Objective:

To provide a depth knowledge about the Microwave and Optical components and in analyzing the microwave and Optical equipment's. The laboratory exercises are designed to give students ability to design, build, and analyze the components.

LIST OF EXPERIMENTS:

1. Study of Micro wave Component
2. Characteristics of Microwave Sources – Klystron and Gunn diode
3. Relationship between frequency, free wave length and guide wave length
4. Determination of VSWR and Impedance
5. Study of Direction Coupler
6. Horn Antenna – Gain and directional Characteristics
7. Three port Circulator
8. Measurement of dielectric constant
9. Study and Characterization of mono mode and multi mode optical fibers
10. Study of Optical Fiber link
11. Measurement of losses in optical fiber
12. Application of optical fiber for ISDN application
13. Measurement of coupling loss in optical fiber
14. Study of Fiber Sensors

Course Outcomes

On completion of the course, student will be able to–

C01	Understand the Microwave and optical devices and makes them to analysis the operation of each device.
C02	Learn detailed practical study on microwave equipment's and microstrip components.
C03	Analyse the optical devices and to use in appropriate application
C04	Design of microwave components characteristics and optical components characteristics
C05	Perform optical fiber application for Integrated service digital networks.

SECX1052	WIRELESS COMMUNICATIONS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To study the overview of cellular system concept.
2. To understand the concept of GSM and GPRS.
3. To study the various characteristics of WAP and cable replacement devices.
4. To understand the concept and characteristics of 3G and B3G systems.

UNIT I

10 hrs

Radio frequency Spectrum: Details of RF Spectrum, Spectrum allocation for wireless communication. Cellular system concepts: Circuit switched Cellular systems (analog and digital), Packet switched cellular system, Types of packet switching- Virtual circuit and Datagram switching. Cellular architecture, Frequency reuse, Cell clusters, reuse factor, channel Assignment. Mobility Management: Handoff – Inter BS Handoff-Inter system Handoff, Strategies of Hand off detection-Mobile controlled Handoff-Network controlled Handoff-Mobile assisted Handoff

UNIT II

10 hrs

GSM Architecture, Radio subsystems, Network and Switching subsystems, Operation subsystem, Layer Modeling (OSI Model), Mobility management GSM Physical layer parameters, Protocol Architecture & Signaling, FDMA and TDMA application in GSM, GSM Short Message Service- SMS Network architecture-Protocol Hierarchy

UNIT III

10 hrs

General Packet Radio Interface (GPRS): GPRS air interface- GPRS network architecture- transmission plane & signaling plane- SGSN and GGSN functions EDGE (Enhanced Data Rate for Global Evaluation): Network architecture-Network control. Short Distance Wireless communication: Architecture, Protocol and technical details of
– Bluetooth – Zigbee – Ultra Wide Band (UWB)-IrDA (Infra red Data Association)

UNIT IV

10 hrs

WAP: WAP model – WAP Gateway – WAP Protocols- Wireless Datagram protocol (WDP)- Wireless Transport layer security (WTLS)-Wireless Transaction protocol (WTP)- Wireless Session protocol (WSP)- Wireless Application Environment (WAE)- WAP user Agent profile and caching model- WAP protocol stack over USSD Wireless Local Loop (WLL): Architecture, WLL technologies- Satellite based Systems-Cellular based system

UNIT V

10 hrs

3G Networks or IMT 2000/UMTS- list of 3G features and Performance. Node B, RNC and Core Network WCDMA: Physical layer-transport channels-Transmission characteristics, FDD Mode-TDD Mode UMTS network architecture: Description-MAC layer-RLC layer-RR layer. CDMA 2000: Radio Interface parameters of CDMA 2000 FDD-channel structure-chip rates-modulation and spreading (single carrier)-Transmission characteristics (single carrier)-1xEV-DO- 1xEV-DV. 3GPP and the latest Releases of 3PP WLAN standards: IEEE 802.11a,b,g,n WiMAX IEEE 802, 12 and 802.20 specifications, OFDM and MIMO applications

Course Outcomes

C01	Classify various generations of wireless communication and standards and Summarize different types of air interface used in different standards.
C02	Demonstrate the applications of different international standards in wireless communication.
C03	Describe the behaviour of different protocol structures in different cable replacement devices.
C04	Appraise and report on advances in higher generations of wireless schemes...
C05	Design conceptually a mobile communication system according to the required standard.

TEXT / REFERENCE BOOKS:

1. William C.Y. Lee., "Wireless & Cellular Telecommunications", 3rd edition, McGraw Hill.2006
2. Yibing Lin, "Wireless & mobile Network architecture", Wiley 2002
3. William Stallings, "Wireless Communication & Networking", Pearson Education, Asia, 2006.
4. Jochen Schiller, "Mobile communications", .2nd Edition, 2003
5. David Tse, Pramod Viswanath, "Fundamentals of Wireless Communications". Cambridge University Press | ISBN 0521845270 | 2005

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 hrs****PART A** :2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B** :2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SECX1040	DIGITAL IMAGE PROCESSING	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To understand the basic principles and methods of digital image processing
2. To have a comprehensive background in image filtering
3. To develop analytic skill to process images

UNIT I

10 hrs

IMAGE PERCEPTION AND SAMPLING - Elements of Digital Image Processing Systems – Elements of Visual Perception – structure of human eye – light, luminance, brightness and contrast, mech band effect – image formation
– Monochrome vision model – Image fidelity criteria – Color vision model – Introduction to 2D system – linear, shift invariant, casual and stable systems – optical and modulation transfer function – 2D sampling theorem – Aliasing – reconstruction of image from samples – Practical limitations in sampling and reconstruction – Image quantization – Lloyd max quantizer – Optimum mean square uniform quantizer.

UNIT II

10 hrs

IMAGE TRANSFORMS - Need for transform – 2D Orthogonal and Unitary transform and its properties – 1D & 2D DFT – Properties – separability, translation, periodicity, conjugate symmetry, rotation, scaling, convolution and correlation – FFT – Statement, proof and properties of Separable transforms – Walsh, Hadamard, Haar, Discrete Sine, DCT, Slant, SVD & KL transforms .

UNIT III

10 hrs

IMAGE ENHANCEMENT AND RESTORATION-. Spatial domain method – point operation – Histogram modelling – Spatial operations – directional smoothening, median filtering, image sharpening, masking, edge crispening, interpolation – Transform operation – linear filtering, root filtering – Homomorphic filtering – Degradation model – diagonalization – Constrained and Unconstrained restoration – Inverse filtering – Wiener filter – generalised inverse, SVD and iterative methods.

UNIT IV

10 hrs

IMAGE ANALYSIS AND PATTERN RECOGNIZATION - Spatial feature extraction – Edge detection – Boundary extraction and representation – region and moment representation – structure – Texture – Scene matching and detection – Image segmentation – Classification techniques Pattern recognition – Perceptron for two pattern classes
– Training algorithm – Non separable classes

UNIT V

10 hrs

IMAGE DATA COMPRESSION - Fundamentals of coding – coding, inter pixel and psychovisual redundancy, fidelity criteria – Image compression models – fundamental coding theorem – Shannon's coding, Huffman coding – Pixel coding – Predictive techniques – lossy and lose less predictive coding – variable length coding – Transform coding – Zonal and threshold coding – Image compression standards – CCITT and JPEG standards.

Course Outcomes

On completion of the course, student will be able to–

C01	Describe the working of microcontroller.
C02	To describe and explain direct ,indirect addressing modes and serial communications.
C03	To evaluate the performance of 8051, PIC architecture .
C04	To analyzethe importance of recent trends in embedded system
C05	To design and analyze the timers and counters

TEXT / REFERENCE BOOKS:

1. William K Pratt, Digital Image Processing,,3rd Edition, John Wiley & Sons, 2001.
2. Greenberg A.D. and S.Greenberg, Digital Images: A Practical Guide, ,1st Edition, McGraw Hill,1995.
3. Nick Efford, Digital image Processing a practical introduction using JAVA, Pearson Education Ltd., 1st Edition, 2000.
4. Edward R Dougherty, Electronic Imaging Technology, 1st Edition, PHI, 2005.
5. Anil .K.Jain, Fundamentals of Digital Image Processing, 1st Edition, PHI New Delhi, 1995.,
6. Gonzalez R.C. and R.E.Woods, Digital Image Processing, 2nd Edition, Pearson Education Ltd 2002.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3hrs

PART A :2 Questions from each unit, each carrying 2 marks. No choice

20 Marks

PART B :2 Questions from each unit with internal choice, each carrying 12 marks

60 Marks

SECX1041	PROGRAMMING IN MATLAB	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To understand basic representation of Matrices and vectors in MATLAB
2. To learn various programming structures in MATLAB
3. To study built in and user defined functions in MATLAB.
4. To become conversant with 2D as well as 3D graphics in MATLAB
5. To find solution for complex mathematical problems
6. To explore MATLAB simulink for various engineering systems and applications

UNIT I

10 hrs

Defining Variables – functions – Matrices and Vectors –Strings – Input and Output statements –Script files – Arrays in Mat lab – Addressing Arrays – Dynamic Array – Cell Array – Structure Array – File input and output – Opening & Closing – Writing & Reading data from files.

UNIT I

10 hrs

Relational and logical operators – Control statements IF-END, IF-ELSE – END, ELSEIF, SWITCH CASE – FOR loop – While loop – Debugging – Applications to Simulation – miscellaneous MAT lab functions & Variables.

UNIT I

10 hrs

Basic 2D plots – modifying line styles – markers and colors – grids – placing text on a plot – Various / Special Mat Lab 2D plot types – SEMILOGX – SEMILOGY – LOG- LOG – POLAR – COMET – Example frequency response of filter circuits.

UNIT I

10hrs

Linear algebraic equations – elementary solution method – matrix method for linear equation – Cramer's method
– Statistics, Histogram and probability – normal distribution – random number generation – Interpolation – Analytical solution to differential equations – Numerical methods for differential equations.

UNIT I

10 hrs

Simulink – Simulink model for a dead zone system, nonlinear system – Applications in DSP – Computation of DFT & FFT – Filter structure –IIR & FIR filter design – Applications in Communication PCM, PCM, DM, DTMF Interfacing of Matlab with event driven simulators.

Course Outcomes

On completion of the course, student will be able to–

CO1	Represent Matrices, vectors and strings in MATLAB, read and write data.
CO2	Classify structures and loops in MATLAB
CO3	Sketch 2D and 3D graphics in MATLAB
CO4	Resolve complex mathematical problems
CO5	Implement MATLAB Simulink for characterizing and analyzing engineering systems

TEXT / REFERENCE BOOKS:

1. William J.Palm, Introduction to MATLAB 6.0 for Engineers, Mc Graw Hill & Co
2. M.Herniter, Programming in MATLAB, Thomson Learning.
3. John G.Proakis, Digital Signal Processing using MATLAB, Thomson Learning.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max.Marks :80****Exam Duration : 3hrs****PART A** :2 Questions from each unit, each carrying 2 marks. No choice**20 Marks****PART B** :2 Questions from each unit with internal choice, each carrying 12 marks**60 Marks**

SECX1060	RADAR AND NAVIGATIONAL AIDS	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To impart the basic knowledge of Radar and Detection of Signals in noise.
2. To discuss Doppler and MTI Radar.
3. To understand the various types of the Radar Antennas.
4. To analyze the methods of Navigation.
5. To implement Microwave Landing System and Doppler Navigation.

UNIT I

10 hrs

Basic Radar-The Origins of Radar, Simple form of Radar Equation-Radar Block Diagram-Radar Frequencies-Application of Radar. The Radar Equation: Introduction-Detection of Signals in noise-Receiver noise and the Signal-to-Noise Ratio-Probability Density Function-Probabilities of Detection and False Alarm-Integration of Radar pulses- Radar Cross Section of Targets-Radar Cross Section Fluctuations-Transmitter Power-Pulse Repetition Frequency- Antenna Parameters-System Losses-Other Radar Equation Considerations.

UNIT II

10 hrs

Introduction To Doppler and MTI Radar-Delay- Line Cancelers-Staggered Pulse Repetition Frequencies-Doppler Filter Banks-Digital MTI Processing-Moving Target Detector-Limitation of MTI Performance-Pulse Doppler Radar- Other Doppler Radar Topics-Tracking with Radar-Monopulse Tracking-Conical Scan and Sequential Lobing-Limitation to Tracking Accuracy-Low-Angle Tracking-Tracking in Range-other Tracking Radar Topics-Comparison of Trackers-Automatic Tracking with Surveillance Radars(ADT).

UNIT III

10 hrs

Detection of Signals in Noise: Introduction-Matched-Filter Receiver-Detection Criteria-Detectors-Automatic Detector-Integrators-Constant-False-Alarm Rate Receivers-The Radar Operator-Signal Management-Propagation Radar waves-Atmospheric Refraction-Standard Propagation-Non Standard Propagation. The Radar Antennas: Reflector Antennas-Electronically Steered Phased Array Antennas-Phase Shifter-Frequency-Scan Arrays Radar Transmitters: Introduction-Linear Beam Power Tubes-Solid State RF Power Sources-Magnetron-Crossed Field Amplifier-Other RF Power Sources-Other aspects of Radar Transmitter. Radar Receivers: The Radar Receiver-Receiver Noise Figure-Superheterodyne Receiver-Duplexers and Receivers Protectors-Radar Displays.

UNIT IV

10 hrs

Introduction-Four Method of Navigation-Radio Direction Finding-The Loop Antenna-Loop Input Circuits-An Aural Null Direction Finder-The Goniometer-Error In Direction Finding-Adcock Direction Finders-Direction Finding at very High Frequencies-Automatic Direction Finders-The Commutated Aerial Direction Finders-Range and Accuracy of Direction Finders Radio Ranges-The LF/MF Four Course Radio Range-VHF Omni directional Range (VOR)-VOR Receiving Equipment-Range and accuracy of VOR-Recent Development Hyperbolic System of Navigation (Loran and Decca)-Loran-A-Loran-A Equipment-Range and Precision of Standard Loran-Loran-C-The Decca Navigation System-Decca Receiver-Range and Accuracy of Decca-The Omega System.

UNIT V

10 hrs

DME and TACAN-Distance Measuring Equipment-Operation of DME-TACAN-TACAN Equipment Aids to Approach and Landing-Instrument Landing System-Ground Controlled Approach System-Microwave Landing System(MLS) Doppler Navigation-The Doppler Effect-Beam Configuration-Doppler frequency Equation-Track Stabilization-Doppler

Spectrum-Components of The Doppler Navigation System-Doppler Range Equation-Accuracy of Doppler Navigation System. Inertial Navigation-Principles of Operation-Navigation Over The Earth-Components of an inertial Navigation System-Earth Coordinate Mechanization-Strapped-Down Systems-Accuracy of Inertial Navigation Systems. Satellite Navigation System-The Transit System-Navstar Global Positioning System(GPS)-Nightvision systems.

Course Outcomes

On completion of the course, student will be able to–

CO1	Explain the basic knowledge of Radar and Detection of Signals in noise.
CO2	Illustrate Doppler and MTI Radar.
CO3	Classify various types of the Radar Antennas.
CO4	Describe the methods of Navigation.
CO5	Explain the Microwave Landing System.

TEXT / REFERENCE BOOKS:

1. Merrill I.Skolnik, "Introduction to Radar Systems", Tata McGraw-Hill (3rd Edition) 2003.
2. Nagaraja.N.S, "Elements of Electronics Navigation", Tata McGraw Hill 1993.
3. Nadav Levanon, "Radar Principles", John Wiley and Sons, 1989
4. Peyton Z. Peebles, "Radar Principles", John Wiley & Sons, 2004
5. Toomay.J.C, "Principles of Radar", 2nd edition- PHI, 2004
6. Brookner, "Radar Technology", Artech Hons,1986.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs

PART A :2 Questions from each unit, each carrying 2 marks. No choice

20Marks

PART B :2 Questions from each unit with internal choice, each carrying 12 marks

60Marks

SECX1043	TELEVISION ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course Objectives

1. To discuss on TV pictures and TV standards.
2. To impart knowledge on camera tubes
3. To understand the usage of different types of Television Receiver.
4. To analyze the behavior of Monochrome and Color TV.
5. To impart the knowledge on Advances In TV Technology

UNIT I

10 hrs

Geo metric form and aspect ratio of the picture- scanning- interlaced scanning-number of scanned lines- vertical and horizontal resolution – picture brightness- transfer characteristics – negative transmission – VSB transmission – Complete channel bandwidth- reception of VSB signals – allocation of frequency band for TV signals- CCIR and FCC standards.

UNIT II

10 hrs

Camera tubes requirements- Iconoscope – Image Orthicon- Vidicon –Plumbicon- Silicon diode array-solid array – solid state image scanning- Gamma collection, Requirements of TV broad cast transmission- TV transmitter – Visual exciter- Aural exciter- Diplexer- transmitting antennas – MW TV relay systems- TV via satellites- CCTV- Cable TV – TV receiver as a data communication terminal-tele conference

UNIT III

10 hrs

Receiver block diagram- receiving antennas- Balun and TV filters- RF tuners –VHF and UHF tuners, IF response – Wave traps, Video Detector, Video amplifier- DC restoration-Sync separator – Vertical and horizontal output stage EHT generation- Picture tube- Beam deflection- Centering and focusing- Geometric distortion in raster- Sound sections.

UNIT IV

10 hrs

Nature of colour- Chromotocity diagram- compatibility with monochrome and vice versa Colour TV- Transmission and Reception-Video Tape recording, VCR/VCPs. Video discs- teletext and video text – Video games

UNIT V

10 hrs

Projection TV- Stereo sound in TV - 3D TV pictures - Digital TV - High definition TV (HD TV) - Flat panel display - LED TV

Course Outcomes

On completion of the course, student will be able to–

CO1	Illustrate various types of standards for Television.
CO2	Acquire the complete knowledge on camera tubes.
CO3	Demonstrate the usage of different types of Television Receiver.
CO4	Describe the behavior of Monochrome and Color TV.
CO5	Explain about advancement in TV technology.

TEXT / REFERENCE BOOKS:

1. R.R.Gulati, Monochrome and Colour Television, 2nd edition, New Age International publishers, 2004
2. A.M.Dhake, Television and Video Engineering, 2nd edition, TMH, 2003.
3. Grob and Bernard, Basic television principles and servicing, Mc Graw Hill, 2004.
4. R.R.Gulati, Modern TV practices:Principles, Technologies & servicing, New Age International, 1991.

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks :80

Exam Duration : 3 Hrs

PART A :2 Questions from each unit, each carrying 2 marks. No choice

20Marks

PART B :2 Questions from each unit with internal choice, each carrying 12 marks

60Marks