Annexure-4
B.Tech (Electronics and Communication Engineering)
Teaching Scheme

Indus Institute of Engineering & Technology, Indus University

B.Tech Electronics and Communication Teaching Scheme 2021-2024

SEMESTER - I

Sr. No.	Subject Code	Name of the subject	CREDIT	Teaching Scheme (per week)				Evaluation Scheme					Segment
								Theory		Practical		Total	
								CIE	End Sem	CIE	End Sem	Marks	
				Th.	Tut.	Pr.	Total (hr.)	Th.	Th.	Pr.	Pr.		
1	MA0111	Calculus	4	3	1	0	4	60	40	0	0	100	**BS**
2	CH0011	Engineering Chemistry	4	3	0	2	5	60	40	60	40	200	**BS**
3	EN0111	Technical Communication	3	1	2	0	3	60	40	0	0	100	**HS**
4	ME0019	Engineering Graphics	3	1	0	4	5	60	40	60	40	200	**ES**
5	CV0004	Environmental Science	2	2	0	0	2	60	40	0	0	100	**ES**
6		Indian Knowledge System	3	3	0	0	3	100	0	0	0	100	**VA**
7	EC0116	*Open Elective 1*	3	2	0	2	4	60	40	60	40	200	**OE**
8	EC0117	*Open Elective 2*	3	2	0	2	4	60	40	60	40	200	**OE**
		TOTAL	**25**	**17**	**3**	**10**	**30**	**520**	**280**	**240**	**160**	**1200**	

SEMESTER - II													
Sr. No.	Subject Code	Name of the subject	CREDIT	Teaching Scheme (per week)				Evaluation Scheme					
								Theory		Practical		Total	
								CIE	End Sem	CIE	End Sem	Marks	
				Th.	Tut.	Pr.	Total (hr.)	Th.	Th.	Pr.	Pr.		Segment
1	MA0211	Differential Equations and Linear Algebra	4	3	1	0	4	60	40	0	0	100	**BS**
2	PH0011	Engineering Physics	4	3	0	2	5	60	40	60	40	200	**BS**
3	EN0211	Business Communication and Presentation Skills	3	1	2	0	3	60	40	0	0	100	**HS**
4	EL0117	Workshop practice	2	0	0	4	4	0	0	60	40	100	**ES**
5	IST0001	Indian Science and Technology	1	1	0	0	1	100	0	0	0	100	**VA**
6	EC0218	Fundamentals of Electronics Devices	4	3	0	2	5	60	40	60	40	200	**ES**
7	EC0219	Electronics Workshop & Practices	2	1	0	2	3	60	40	60	40	200	**ES**
8	EC0216	Open Elective 3	3	3	0	0	3	60	40	60	40	200	**OE**
		TOTAL	**23**	**15**	**3**	**10**	**28**	**460**	**240**	**300**	**200**	**1200**	

SEMESTER - III													
Sr. No.	Subject Code	Name of the subject	CREDIT	Teaching Scheme (per week)				Evaluation Scheme					Segment
								Theory		Practical		Total	
								CIE	End Sem	CIE	End Sem	Marks	
				Th.	Tut.	Pr.	Total (hr.)	Th.	Th.	Pr.	Pr.		
1	MA0311	Probability, Statistics & Numerical Methods	4	3	1	0	4	60	40	0	0	100	**BS**
2	EC0316	Control Theory	3	2	1	0	3	60	40	0	0	100	**ES**
3	EC0317	Analog Electronics	4	3	0	2	5	60	40	60	40	200	**Core**
4	EC0318	Network Analysis	3	2	1	0	3	60	40	0	0	100	**Core**
5	EC0319	Digital Electronics	4	3	0	2	5	60	40	60	40	200	**Core**
6	EC0322	Design Thinking	2	1	0	2	2	60	40	60	40	200	**BS**
7	SS0301	Human Values and Professional Ethics	2	2	0	0	2	100	0	0	0	100	**HS**
8	EC0321	Internship Credit	2	0	0	0	0	0	0	100	0	100	**IC**
		TOTAL	**24**	**16**	**3**	**6**	**24**	**460**	**240**	**280**	**120**	**1100**	

SEMESTER - IV													
Sr. No.	Subject Code	Name of the subject	CREDIT	Teaching Scheme (per week)				Evaluation Scheme					
								Theory		Practical		Total	
								CIE	End Sem	CIE	End Sem	Marks	
				Th.	Tut.	Pr.	Total (hr.)	Th.	Th.	Pr.	Pr.		Segment
1	**EC0423**	Microprocessor & Microcontroller	4	3	0	2	5	60	40	60	40	200	Core
2	**EC0417**	Linear Integrated Circuits	4	3	0	2	5	60	40	60	40	200	Core
3	**EC0418**	Signals & Systems	4	3	1	0	4	60	40	0	0	100	Core
4	**BB0311**	Management for Engineers	2	2	0	0	2	60	40	0	0	100	HS
5	**EC0419**	Digital System Design	3	2	0	2	4	60	40	60	40	200	Core
6	**EC0421**	Open Elective 4	3	3	0	0	3	60	40	0	0	100	OE
8	**EC0422**	Open Elective 5	3	3	0	0	3	60	40	0	0	100	Extra OE Credit
		TOTAL	**20**	**16**	**1**	**6**	**24**	**460**	**240**	**120**	**80**	**900**	

SEMESTER - V													
Sr. No.	Subject Code	Name of the subject	CREDIT	Teaching Scheme (per week)				Evaluation Scheme					Segment
								Theory		Practical		Total	
								CIE	End Sem	CIE	End Sem	Marks	
				Th.	Tut.	Pr.	Total (hr.)	Th.	Th.	Pr.	Pr.		
1	**EC0516**	Principles of Communication Systems	3	3	0	0	3	60	40	0	0	100	Core
2	**EC0517**	Electromagnetics	4	3	1	0	4	60	40	0	0	100	Core
3	**EC0525**	Python Programming	4	3	0	2	5	60	40	60	40	200	Core
4	**EC0519**	Sensors & Transducers	4	3	0	2	5	60	40	60	40	200	PE1
	EC0526	Advanced Electronics											
	EC0527	System Verilog for verification											
5	**EC0522**	Digital Signal Processing	4	3	0	2	5	60	40	60	40	200	Core
6		Entrepreneurship Development	2	2	0	0	2	60	40	0	0	100	HS
7	**EC0523**	Internship Credit	2	0	0	0	0	0	0	100	0	100	IC
8	**EC0524**	***Open Elective 6***	**3**	**3**	**0**	**0**	**3**	**60**	**40**	**0**	**0**	**100**	**Extra Credit OE**
		TOTAL	**23**	**17**	**1**	**6**	**24**	**360**	**240**	**240**	**120**	**1000**	

SEMESTER - VI													
Sr. No.	Subject Code	Name of the subject	CREDIT	Teaching Scheme (per week)				Evaluation Scheme					
								Theory		Practical		Total	
								CIE	End Sem	CIE	End Sem	Marks	
				Th.	Tut.	Pr.	Total (hr.)	Th.	Th.	Pr.	Pr.		Segment
1	**EC0616**	VLSI Design	4	3	0	2	5	60	40	60	40	200	Core
2	**EC0617**	Data communication and Networking	3	2	0	2	4	60	40	60	40	200	Core
3	**EC0618**	Digital Communication	4	3	0	2	5	60	40	60	40	200	Core
4	**EC0624**	Microwave and Radar Engineering	4	3	0	2	5	60	40	60	40	200	PE2
	EC0620	Optical Communication											
	EC0621	Digital Image Processing											
5	**EC0623**	*Open Elective-7*	3	3	0	0	3	60	40	0	0	100	OE
		TOTAL	**18**	**14**	**0**	**8**	**22**	**300**	**200**	**240**	**160**	**900**	

SEMESTER - VII													
Sr. No.	Subject Code	Name of the subject	CREDIT	Teaching Scheme (per week)				Evaluation Scheme					
								Theory		Practical		Total	
				Th.	Tut.	Pr.	Total (hr.)	CIE Th.	End Sem Th.	CIE Pr.	End Sem Pr.	Marks	Segment
1	EC0716	Cryptography and Cyber Security	3	3	0	0	3	60	40	0	0	100	ES
2	EC0728	*Open Elective 8*	3	3	0	0	3	60	40	0	0	100	OE
3	EC0717	Wireless Communication	4	3	0	2	5	60	40	60	40	200	PE3
	EC0718	Biomedical Instrumentation and Imaging											
	EC0719	Embedded System											
4	EC0733	Machine learning	4	3	0	2	5	60	40	60	40	200	PE4
	EC0721	Antenna & Wave Propagation											
	EC0722	Error correcting codes											
5	EC0723	Satellite Communication	3	2	0	2	4	60	40	60	40	200	PE5
	EC0724	IOT and Applications											
	EC0725	Analog VLSI design											

6	MA0712	Optimization Techniques	3	2	1	0	3	60	40	0	0	100	BS
7	EC0727	Internship Credit	2	0	0	0	0	0	0	100	0	100	IC
8	EC0729	Open Elective 9	3	3	0	0	3	60	40	0	0	100	Extra Credit OE
	EC0730	Robotics and Computer Vision											
	EC0731	Mobile Communication and Networks											
9	EC0732	IoT Communication Networks	4	3	0	2	5	60	40	60	40	200	Extra Credit PE
		TOTAL	**22**	**16**	**1**	**6**	**23**	**360**	**240**	**180**	**120**	**900**	

SEMESTER - VIII

Sr. No.	Subject Code	Name of the subject	CREDIT	Teaching Scheme (per week)				Evaluation Scheme					Segment
								Theory		Practical		Total	
								CIE	End Sem	CIE	End Sem	Marks	
				Th.	Tut.	Pr.	Total (hr.)	Th.	Th.	Pr.	Pr.		
1	EC0816	Project	15	0	0	30	30	0	0	60	40	100	Project
		TOTAL	**15**	**0**	**0**	**30**	**30**	**0**	**0**	**60**	**40**	**100**	
		* Students to have options of micro electives (modules of approx. 30 hrs. being taken by domain experts on the basis of availability and approval of Hon'ble EP through respective Director and Dean)											

		* MOOCs, micro electives to be kept as options for students aspiring for accruing more credits as per their capabilities, while making these available also for satisfying the departmental and open electives which are mandatory with appropriate approval from EP through respective Director and Dean Faculty	
		*We are offering 9 open electives out of which 6 open electives are compulsory for students to opt. while for 3 open electives, if a student opts he/she can earn 9 extra credits.	

List of Open Electives for Students of B.Tech (ECE)

SEM	Open Elective	Subject Code	Offering Department	Subject		Teaching Scheme		
					Credits	Th.	Tut	Pr
1	Open Elective 1	CE0116	CE/CS/IT	Computer programming	3	2	-	2
		AU0121	Auto	Basic Automobile Engineering	3	3	0	0
			Meta	Metallurgy for Non-Metallurgists	3	3	0	0
		EL0116	EL	Basics of DC Circuits	3	3	0	0
		ME0118	Mech	Basic Mechanical Engineering	3	2	0	2
		CV0121	Cvl	Basics of Civil Engineering	3	2	0	2

1	**Open Elective 2**	CE0117	CE/CS/IT	Information Communication Technology (Networking Basics)	3	2	-	2
		AU0122	Auto	Fundamentals of Automobile Engines	3	2	0	2
			Meta	Materials Science	3	3	0	0
		EL0117	EL	Basics of AC Circuits	3	3	0	0
		ME0220	Mech	Introduction to Design & Innovation	3	3	0	0
		CV0122	Cvl	Applied Mechanics	3	2	1	0
2	**Open Elective 3**	CE0218	CE/CS/IT	Object Oriented Programming	3	2	-	2
		AU0123	Auto	Fundamentals of Automobile Systems	3	2	0	2
			Meta	Advanced Materials	3	3	0	0
		EL0216	EL	AC & DC Machines	3	3	0	0
		ME0221	Mech	Introduction to Smart Material	3	2	0	2

		CV0223	Cvl	Solid Waste Management	3	3	0	0
4	**Open Elective 4**	CE0419	CE/CS/IT	Cyber Security and Intellectual Property Rights	3	3	-	-
		AU0421	Auto	Off Road Vehicles	3	3	0	0
			Meta	Metal Casting and Solidification	3	3	0	0
		EL0422	EL	Solar and Wind Energy System	3	3	0	0
		ME0434	Mech	Roadmap for Patent creation	3	3	0	0
		CV0424	Cvl	Engineering Materials for Sustainability	3	3	0	0
			SH	Complex Analysis	3	2	1	0
4	**Open Elective 5**	CE0420	CE/CS/IT	Web Design	3	2	-	2
		AU0422	Auto	Modern Vehicle Technology	3	3	0	0
			Meta	Energy Economy and Waste Management	3	3	0	0

		EL0423	EL	Solid State Devices and Applications	3	3	0	0
		ME0435	Mech	Energy Management	3	3	0	0
		CV0425	Cvl	Metro Systems and Engineering	3	2	0	2
			SH	Discrete Mathematics	3	2	1	0
5	**Open Elective 6**	CE0523	CE/CS/IT	Python Programming	3	2	-	2
		AU0521	Auto	Modern Quality Tools	3	3	0	0
			Meta	Nano Technology	3	3	0	0
		EL0523	EL	Photovoltaic System	3	3	0	0
		ME0544	Mech	Introduction to Robotics	3	3	0	0
		CV0526	Cvl	Disaster Management	3	3	0	0
			SH	Finite Element Method	3	2	1	0
6	**Open Elective 7**	CE0625	CE/CS/IT	Android Programming	3	2	-	2
		AU0621	Auto	Intelligent Vehicle Technology	3	3	0	0

			Meta	Recycling of Materials	3	0	0	3
		EL0627	EL	Sensors and Actuators	3	3	0	0
		ME0545	Mech	Non-Conventional Energy sources	3	3	0	0
		CV0627	Cvl	Green Buildings	3	3	0	0
			SH	Graph Theory	3	2	1	0
7	**Open Elective 8**	CE0724	CE/CS/IT	Artificial Intelligence	3	2	-	2
		AU0721	Auto	Transport Management	3	3	0	0
			Meta	Selection of Materials and Failure Analysis	3	3	0	0
		EL0727	EL	Programmable Logic Control	3	3	0	0
		ME0657	Mech	Rapid Prototyping	3	3	0	0
		CV0728	Cvl	Public Transportation Systems	3	3	0	0
			SH	Artificial Neural Network and Soft Computing	3	2	1	0

7	**Open Elective 9**	CE0725	CE/CS/IT	Big Data & Business Analytics	3	2	-	2
		AU0722	Auto	Automobile Quantitative Techniques	3	3	0	0
			Meta	Non-Destructive Testing	3	3	0	0
		EL0728	EL	FACTS Devices	3	3	0	0
		ME0765	Mech	Introduction to Research	3	3	0	0
		CV0729	Cvl	Remote Sensing & GIS	3	3	0	0
			SH	Optimization Techniques	3	2	1	0

Open Electives offered by EC department

SEM	Open Elective	Subject Code	Offering Department	Subject		Teaching Scheme		
					Credits	Th.	Tut	Pr
1	Open Elective-1	EC0116	EC	Electronics Devices and Circuits	3	2	0	2
1	Open Elective-2	EC0117	EC	Electronics Simulation and Design Lab	3	2	0	2
2	Open Elective-3	EC0216	EC	Electronics Instrumentation	3	3	0	0
4	Open Elective-4	EC0421	EC	Signals & Systems	3	3	0	0
5	Open Elective-5	EC0422	EC	Modern Communication Trends	3	3	0	0
5	Open Elective-6	EC0524	EC	Digital Signal Processing	3	3	0	0
6	Open Elective-7	EC0623	EC	Digital Image Processing	3	3	0	0
7	Open Elective-8	ECO728	EC	Robotics	3	3	0	0
7	Open Elective-9	EC0729	EC	Pattern Recognition Techniques	3	3	0	0

Annexure-6
B.Tech (ECE) Syllabus

SEMESTER-I/II
Syllabus

Subject: Fundamentals of Electronics Devices								
Program: **B.Tech (EC)**				Subject Code: EC0218			Semester: II	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	16/40	16/40	24/60	24/60	200

Course Objectives:

1. To describe the concepts of semiconductor physics.
2. To analyze and recognize basic electronic components and devices used for different electronic functions.
3. To analyze the design and test basic electronic circuits using active components.
4. To describe problem solving techniques in simple electronic circuits

CONTENTS

UNIT-I **[8 hours]**

Charged Particles, Field Intensity, Potential Energy, The eV Unit of Energy, Nature of Atom, Atomic Energy Levels, Electronic Structure of the Elements, Energy distribution of electrons, Fermi-Dirac function, Energy Band Theory of Crystals, Insulators, Semiconductors and Metals Mobility and Conductivity, Electrons and Holes in an Intrinsic Semiconductor, Donor and Acceptor Impurities, Charge Densities in a Semiconductor, Electrical properties of Ge and Si, Hall Effect, Conductivity Modulation, Generation and Recombination of Charges, Diffusion, The Continuity Equation, Injected Minority–Carrier Charge, Potential variation within a Graded Semiconductor.

UNIT-II **[8 hours]**

Open circuit p-n Junction, p-n Junction as a Rectifier, Current Components in a p-n diode, VoltAmpere Characteristic, Temperature Dependence of the V/I Characteristic, Diode Resistance, Space Charge, Transition Capacitance, Charge-Control Description of a Diode, Diffusion Capacitance, Junction Diode Switching Times, Breakdown Diodes, Tunnel Diode, Semiconductor Photodiode, Photovoltaic Effect, Light –Emitting Diodes, Schottky diode, varactor diode, GUNN diode, SCR Diode as a Circuit Element, Load-Line Concept, Piecewise Linear Diode Model, Clipping Circuits, Clipping at Two Independent Levels, Comparators, Sampling Gate, Rectifiers, Other Full-Wave Circuits, Capacitor Filters, Additional Diode Circuits

UNIT-III **[8 hours]**

Junction Transistor, Transistor Current Components, Transistor as an Amplifier, CB Configuration, CE Configuration, CC Configuration, Analytical Expressions for Transistor Characteristics Maximum Voltage Rating, Phototransistor, Transistor biasing.

UNIT-IV **[8 hours]**

Junction field effect transistor, drain curves, transcoductance curves, biasing in ohmic and active region, JFET amplifiers, JFET as a switch, The Depletion-Mode MOSFET, D-MOSFET Curves, Depletion-Mode MOSFET Amplifiers, The Enhancement-Mode MOSFET, The Ohmic Region, Digital Switching, CMOS, CMOS based logic gates design and truth tables. Introduction to Op Amps, 741 Op Amp, The Inverting Amplifier, The Noninverting Amplifier, Summing Amplifier, Voltage follower using Opamp

Course Outcomes

After successful completion of this course, students will be able to

1. Able to recognize various electronics components and understand their applications for various applications.
2. Able to analyze and test basic electronics circuits.
3. Able to solve basic design problems related to basic electronic circuits.

Text Books:

1. Integrated Electronics' By J. Millman and C. C. Halkias, Chetan Parikh, 2nd Ed., Tata McGraw Hill Publication.
2. Electronic Principles' by Albert Malvino and David Bates, 7th Ed., Tata McGraw Hill Publication

Reference Books:

'Electronic Devices and Circuit Theory' by Robert Boylestad and Louis Nashelsky, 9th Ed., Prentice Hall India

Web Resources

1. NPTEL MOOC course on the Basic Electronics (https://onlinecourses.nptel.ac.in/noc17_ee02/preview)

2. NPTEL MOOC course on the Solid State Physics (https://onlinecourses.nptel.ac.in/noc17_ph08/preview)

Subject: **Electronics Workshop & Practices**								
Program: **B.Tech (EC)**				Subject Code: EC0219			Semester: II	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
1	0	2	2	16/40	16/40	24/60	24/60	200

LIST OF EXPERIMENTS

Experiment. No.	**Title**	**Learning Outcomes**
1.	**Introduction to Basic electronic components/ Testing /Soldering**	
1.1	Study of various types of Active & Passive Components based on their ratings and to draw symbols of various electronic components on drawing sheets.	To identify different active and passive components and to make a comparative analysis.
1.2	Familiarization/Application of testing instruments and commonly used equipments.[Multimeter, Function generator, Power supply, CRO etc]	To learn the use of voltage source and testing/ measuring instruments.
1.3	Measuring/Testing of electronic components [Resistor, Capacitor, Diode, Transistor, UJT and JFET using multimeter]	Compare the measured values with the calculated values by using measuring/testing instruments
1.4	Sketch, mount and test at least six from following electronic circuit on breadboard: ● T type attenuator ● π-type attenuator ● Forward/reverse biased PN Junction diode ● Transistor as a switch ● Opto coupler using LED & Photo diode ● Light operated relay ● Diode clipper ● Diode clamper ● +/- 5V Regulated power supply with LED indication	To design and test various electronic circuits using commonly used workshop tools.

1.5	Soldering shop: Inter-connection methods and soldering practice using general purpose PCB for any two following electronic circuits with all safety precautions ● Fabrication of DC regulated power supply/ Variable power supply using LM317 ● Forward/reverse biased PN Junction diode ● Zener diode as shunt regulator ● Half wave Rectifier, Full wave & Bridge rectifier ● Light operated relay ● Diode clipper ● Diode clamper ● Low pass filter, High pass filter ● Band pass filter, Band reject filter	To learn the soldering techniques with necessary safety for building and wiring electronic circuits.
1.6	De-solder any two electronic circuits from the following list with all safety precautions ● Fabrication of DC regulated power supply/ Variable power supply using LM317 ● Forward/reverse biased PN Junction diode ● Zener diode as shunt regulator ● Half wave Rectifier, Full wave & Bridge rectifier ● Light operated relay ● Diode clipper ● Diode clamper ● Low pass filter, High pass filter ● Band pass filter, Band reject filter	To de-solder the electronic circuit using de-solder pump, De-solder wick etc.
2.	**PCB Design**	
2.1	Identification of various types of Printed Circuit Boards (PCB)	To learn different PCB's.
2.2	Introduction to PCB design software	To learn the PCB design software.
2.3.	PCB Lab: a. Artwork & printing of a simple PCB. b. Etching & drilling of PCB.	To learn the basic steps involved in PCB designing.

2.4	1. To prepare layout (manually) of a given circuit on paper. 2.To draw schematic and layout of given electronic circuit using any PCB design software: ● Fixed voltage power supply with transformer, rectifier diode, capacitor filter, zener/IC regulator. ● LED blinking circuit using a stable multi-vibrator with transistor BC 107. ● Square wave generation using IC 555 timer in IC base. ● Sine wave generation using IC 741 OP-AMP in IC base. ● RC coupled amplifier with transistor BC 107. ● AND , NAND gates in diode transistor logic.	● To design PCB layout manually. ● To draw the schematic and layout of given electronic circuit using any simple PCB design software.
2.5	Trace electronic circuit from the given PCB layout of an electronic circuit.	To trace circuit from given PCB layout on the PCB.
3.	**Simulation using EDA software (PSpice, MultiSim, Proteus or CircuitLab)**	
3.1	Design and simulation of function generator to generate sine wave, square wave and ramp signal.	To design and simulate function generator using EDA software.
3.2	Verification of Network Theorems: Thevenins, Nortons and Maximum power Transfer.	To design, simulate and verify network theorems using EDA software.
4.	**Mini Project- (Any one) with brief Project Report**	
4.1	Simple Microphone to Speaker Amplifier Circuit	● To fabricate PCB & build the given circuit on the PCB. ● To test the assembled circuit on PCB. ● To prepare a project report in proper format.
4.2	AC to DC converter circuit	
4.3	Soft Start Circuit for Power Supply	
4.4	Voltage Regulator Circuits	
4.5	2-Way Light Switch	
4.6	Temperature Controlled DC Fan using Thermistor	

4.7	Automatic Street Light Controller Circuit Using Relay and LDR	
4.8	Music Operated Dancing LEDs	
4.9	Door Bell using IC 555	
4.10	Water Level Indicator Alarm	

Course Outcome:

1. Develop skill in selection and use of commonly used tools, equipment, components in a given situation.
2. Develop skill in wiring, soldering and de-soldering works
3. Develop skill in tracing circuits of simple (analog and digital) electronic assembly.
4. Students gets hands-on assembling, testing, assembling, dismantling, fabrication and repairing systems by making use of the various tools and instruments available in the Electronics Workshop.

Text Books:

1. Printed Circuit Boards: Design and Technology Bossart TMH, 2008 or latest edition
2. Modern World Transistor Data & Its Equivalent Lotia, M. B P B, 2008
3. Muhammed H Rashid, “Introduction to PSpice using OrCAD for circuits and electronics”, 3rd Edition, Prentice Hall, 2003.
4. Electronic Formulas, Tables Symbols Sharma, M.C B P B, 2008
5. Everyday Electronics Data Book Mike Tooley B P B, 2015

Reference Books:

1. Build Your Own Printed Circuit Board Al Williams Mc GrawHill, 2003 or latest edition Reference Book
2. Making Printed Circuit Boards Jan Axelsen Mc GrawHill, 1993 or latest edition
3. Hobby Electronics Project Special BPB B P B, 2011

Web Resources

1. http://eecs.vanderbilt.edu/courses/ee213/Breadboard.htm
2. http://eecs.vanderbilt.edu/courses/ee213/Breadboard.htm
3. http://wiring.org.co/learning/tutorials/breadboard/index.html
4. http://www.kpsec.freeuk.com
5. http://courses.engr.illinois.edu/ece343/breadboard.htm
6. http://library.thinkquest.org/16497/projects/index.html

7. http://www.technologystudent.com/elec1/tranbrd1.htm
8. http://circuiteasy.com/
9. www.expresspcb.com/expresspcbhtm/download.htm
10. www.freepcb.com/
11. http://www.circuitstoday.com/simple-electronics-projects-and-circuits

SEMESTER-III
Syllabus

Subject: Probability, Statistics & Numerical Methods								
Program: B. Tech. (CE, Civil, EC, Meta)				**Subject Code:** MA0311				**Semester: III**
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	1	0	4	40	0	60	0	100

- **Practical will be based on a Computational software or tool.**

Unit 1	**Basics of Probability:** Introduction to Probability, Characteristics of random variable, Probability mass function, cumulative distribution function, probability density function. **Probability distributions:** Discrete distributions: Binomial distribution, Poisson distribution, Continuous distributions: Normal distribution	11 hours
Unit 2	**Statistics:** Introduction and application of statistics, types of statistics, testing of hypothesis**,** Mean, standard deviation, coefficient of variation, F-test , t-test , Chi Square test, Correlation and regression.	11 hours
Unit 3	**Interpolation** Finite differences and Interpolation: Finite differences Forward, Backward & Central difference operators and difference tables. Interpolation Formulae with equal intervals: Newton's forward, Newton's backward, Central difference interpolation by Stirling's formulae Interpolation Formulae with unequal intervals: Lagrange's & Newton's divided difference interpolation Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule. Numerical differentiation: Using Newton's forward and backward interpolation formula	11 hours
Unit 4	**Numerical Methods** Basic Errors. Solution of Algebraic and Transcendental Equations: Bisection method, Regula-Falsi method, Newton-Raphson method., Convergence condition for these methods, Numerical methods in Linear Algebra: Gauss-Jacobi, Gauss-seidel method Largest Eigen values and corresponding Eigen vectors: By power method Numerical Solutions of ordinary differential equations: Taylor's Method, Euler's Method, Improved Euler Method (Heun's Method), Runge-Kutta method of order four	12 hours

Text Book: B. V. Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill.

Reference Books:

1. Erwin Kreyszig, “Advanced Engineering Mathematics” (8th Edition), Wiley Eastern Ltd., New Delhi.
2. Dr. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, New Delhi
3. Murray Spiegel , “Advanced Mathematics for Engineering & Science: Schaum’s Outline Series”, Tata McGraw Hill Publication
4. Merel C Potter, J.L. Goldberg, “Advanced Engineering Mathematics” (3rd Edition), Oxford India Publication.

Subject: Control Theory								
Program: B. Tech. EC Engg				**Subject Code:** EC0316			**Semester: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
2	1	0	3	40	0	60	0	100

Course Objectives

1. To understand the basic elements and structures of feedback control systems.
2. To Specify control system performance in the frequency-domain in terms of gain and phase margins, and design compensators to achieve the desired performance.
3. To develop & design electronic control systems.

CONTENTS

UNIT-I **[8 hours]**

Introduction to Basic Concepts & Mathematical modeling

Definition of control system, Open loop & close loop control system with examples, Classification of control system, Properties of a good control system, Open loop vs Closed-loop control system

Transfer Function, properties, advantages and disadvantages of transfer function, poles and zeros of Transfer Function, State variable model, Mechanical system modeling, Dynamic model of RLC network, Analogous Systems.

Block diagram formulation, Block diagram reduction, Signal Flow graph, Mason's Gain formula

UNIT-II **[8 hours]**

Transient response analysis

Standard test signals, First-order and second order systems, Higher order systems, Transient response of system, Steady-state error for unit, ramp and parabolic inputs.

UNIT-III **[8 hours]**

Time domain Stability Analysis & Root Locus

RH stability criteria, Effect of Proportional, derivative and integral control, MATLAB simulations, Introduction to root locus, Rules for constructing the root locus, System analysis with the help of Root-locus, Root-locus plot using MATLAB

UNIT-IV **[8 hours]**

Frequency Response Analysis

Introduction, Specification for frequency response, Polar-plots, Bode plots, Nyquist plots, Stability analysis, MATLAB simulations

Course Outcomes

1. To understand the basic elements and structures of feedback control systems. **[BT-2]**
2. To Specify/Determine control system performance in the frequency-domain in terms of gain and phase margins, and design compensators to achieve the desired performance. **[BT-3]**
3. To determine the stability of a closed-loop control system. **[BT-3]**
4. Apply root-locus technique to analyze control systems **[BT-4]**
5. To develop the techniques to analyze the response and stability of systems with applications to design electronic control systems. **[BT-4]**
6. To develop & design electronic control systems. **[BT-6]**

Text Books:

1. Katsuhiko Ogata, "Modern Control Engineering", 4th Ed, Prentice Hall of India.
2. Benjamin C.Kuo, "Automatic Control Systems", John Wiley & Sons

Reference Books:

1. Norman S Nise, "Control system Engineering", 4th Ed., Wiley-India Edition
2. I J Nagrath, M Gopals "Control system Engineering", 5th Ed.

Subject: Analog Electronics

Program: B. Tech. EC Engg				**Subject Code: EC0317**			**Semester: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Objectives :

- Learn the biasing techniques of BJT, and carry out DC and AC analysis and design of BJT amplifier circuits.
- Design and analyze MOS and MOSFET based circuits
- Design and analyze power supply, series and shunt voltage regulators using BJTs,power amplifier

UNIT-I **[14]**

Transistor at Low Frequencies and Transistor Biasing

Bipolar Transistor Biasing Single Resistor biasing, voltage divider biasing and bias stability, integrated circuit biasing, multi stage circuits, biasing for FETs

Transistor at Low Frequencies Graphical Analysis of CE Configuration, Transistor Hybrid Model, The h Parameters conversion formula for the parameter, Analysis of transistor amplifier using h parameters. The emitter follower. Millers theorem, cascading transistor amplifier

UNIT-II **[11]**

Feedback Amplifiers & Oscillators

Feedback Amplifier-classification of basic amplifiers, the feedback concept, transfer gain with feedback, characteristics of feedback, input & output resistance of feedback,

Methods of analysis of feedback amplifiers, voltage series, current series , voltage shunt and current shunt feedback amplifiers.

Sinusoidal Oscillator, Phase Shift Oscillators, Resonant circuit oscillators, A general forms of oscillators, Wien bridge oscillator, crystal oscillator, Frequency Stability.

UNIT-III **[11]**

Power Amplifiers

Output Stages and Power amplifier , Series and Shunt voltage regulator Concepts and Design ,Classification of amplifiers,2nd order and higher order Harmonic Distortions, Class B push pull amplifier, Class AB Amplifier, Power Circuits and Systems Series voltage regulator Shunt Voltage Regulator

UNIT-IV **[12]**

Operational Amplifiers & Multivibrators

Operational amplifier Transistorized, Differential amplifier, emitter coupled differential amplifier, transfer characteristic of differential amplifier. example of IC operational amplifier, measurement of OPAMP parameters

Multi Vibrators, Mono stable Astable and Bistable Multivibrators

Course Outcomes:

1. To understand the various biasing techniques . [BT 2]
2. To analyze the biasing circuits, feedback circuits, oscillator, regulated power supply. [BT 3]
3. To select the components like Transistors, diodes, capacitors, resistors for appropriate application [BT-4,6]
4. To design the biasing techniques, oscillators, regulated DC power supply, differential amplifier [BT 6]
5. To explain the operation of various oscillators and transistorized regulated power supplies ideal characteristics of op amp [BT 2]
6. To create various application like water level indicator, clap switch, power amplifier etc [BT 4,6]

Text Books:

1. Jacob Millman and Christos Halkias “Integrated Electronics” Tata Mc Grow Hill edition

2. Donald Neamen “Electronics Circuits Analysis and Design”, Tata McGrow Hill 2nd Edition onwards.
3. Shalivahanan “Electronics Devices and Circuits”, Tata McGrow Hill 3rd Edition onwards.

Reference Books:

1. Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, 9th Ed. Pearson Education..
2. David Bell “Solid State Pulse Circuits” PHI-Prentice Hall of India, fourth edition Onwards
3. Adel S Sedra& Kenneth C Smith, “Micro Electronic Circuits” 5th Indian Edition, Oxford University Press,2006
4. T.L.Floyd, David Buchla, “Fundamentals of Analog Circuits”2nd Ed, Pearson, 2012

Digital Learning Resources:

NPTEL Video Lecture series Prof Radhakrishnan:, IIT Madras “Analog Signal Processing I & II” Online Courses from NPTEL, Coursera and EDX

Subject: Network Analysis								
Program: B. Tech. EC Engg				**Subject Code: EC0318**			**Semester: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
2	1	0	3	40	0	60	0	100

Course Objectives :

- Analyze circuits with passive components
- Apply to determine transient response of RLC circuit
- Synthesize various waveform and determine circuit response for particular input
- Analyze two port network
- Determine equivalent circuit of given network

UNIT-I **[12]**

Introduction to Basic Concepts & Network Equations

Electromotive force, potential, voltage, current, Resistor, capacitor, inductor, Voltage and current sources, Dependent sources, Dot conventions , current directions, Network Equations

Nodal analysis, Mesh analysis, Source transformation, Analysis of circuit containing dependent sources, Superposition theorem, Substitution Theorem, Compensation theorem, Thevenin's and Norton's theorem, Maximum power transfer theorem

UNIT-II **[12]**

Time domain response of linear circuits

Mathematical preliminaries, DC response of first order and second order circuits, Initial conditions in the network, Charging and discharging of capacitor, Charging and discharging of inductor, Solution of circuit equations by using Initial Conditions.

UNIT-III **[12]**

Laplace transform analysis: Circuit Applications

Manipulation of impedance and admittance, Equivalent Laplace transform of circuit elements, RLC circuit analysis using Laplace transform, Switching in RLC circuit, Waveform synthesis, Circuit analysis in Laplace transform

UNIT-IV **[12]**

Two Port Network

Y- Parameter, Z-Parameter, h-parameter, ABCD-parameter, Relation between two port parameters, Parallel connection of two network

Course Outcomes:

1. Understand and solve the circuits using node and mesh analysis [BT 2].
2. Apply the concept of different network theorems and use the optimum method to solve the circuit [BT 3].
3. Understand the working of capacitor and inductor and how to apply initial conditions [BT 2].
4. Apply Laplace transform to solve the circuits [BT 3].
5. Understand two port parameters and how to find out different types of them [BT 2].
6. Apply the concept of source transformation and reduce the complex circuit [BT 3].

Text Books:

Network Analysis :- By M.E Van Valkenburg PHI Publication

Reference Books:

1. Network Analysis & Synthesis By Franklin S. KUO, Wiley Publication
2. Electric Circuits and Networks :- By K. S. Suresh Kumar – Pearson Education
3. Linear Circuits Analysis 2nd edition :-By DeCarlo/ Lin – Oxford University Press(Indian edition)
4. Engineering Circuit Analysis : - By W H Hayt, J E Kemmerly, S M Durbin 6th Edition TMH Publication
5. Graphs: Theory and Algorithms By K. Thulasiraman, m.n.s Swamy, Wiley Publication.
6. Electric Circuit Analysis By S N Sivanandam, Vikas Publishing House
7. Introductory Circuit Analysis by Robert Boylestad, Pearson

Subject: Digital Electronics								
Program: B. Tech. EC Engg				**Subject Code: EC0319**			**Semester: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Outcomes :

Students can design the basic digital systems or modules (Adder, Substructures, Counters, and Register etc.) This is required for Microcontroller/Microprocessor architectures.

UNIT-I **[12]**

Binary Numbers

Introduction to Digital and Analog System, Octal, Decimal and Hexadecimal Numbering Systems,Binary Numbering System, Binary Conversion, Binary Operation, Gray Code, BCD code, Excess Three code

Boolean Algebra

Axioms and Laws of Boolean Algebra De Morgan's Theorem, Duality and Dual Simplification of Boolean Algebra using K-map and Tabulation method

UNIT-II **[12]**

Logic Gates

Basic Gates: AND, OR, NOT, Universal gates: NAND, NOR, X-OR, X-NOR and BUFFER ,Logic Operations, NAND and NOR implementation, Sum of product and product of sum representation

Logic Families

Introduction, Noise Margins, Fan-in and Fan-out, RTL and DTL logic, Integrated-Injection Logic Emitter-Coupled Logic, Complementary MOS

UNIT-III **[12]**

Combinational Logic

Introduction, Code Conversion, Multilevel NAND and NOR circuit, Various types of Adders and Subtractors, Magnitude Comparator, Decoders, Multiplexers, Programmable Logic Array

Sequential Logic

Introduction, Flip-Flops, Triggering of Flip-Flops, Conversion of Flip-Flops

UNIT-IV **[12]**

FSM, Counter and Shifters Design

FSM Design, Ripple Counter(Asynchronous Counter), Synchronous Counter, Serial-in, Serial-out Shift Register, Parallel-in, Serial -out Shift Register, Serial-in, Parallel-out Shift Register, Parallel-in, Parallel-out Shift Register, Universal Shift Register.

Course Outcomes:

1. To Understand number representation and able to perform conversion between different
2. representation in digital electronic circuits. [BT 2]
3. To Familiar with basic logic gates and Independently or work in team to create logic circuits using logic gates. [BT 6]
4. To Remember Boolean algebra and apply basic properties of Boolean algebra to simplify Boolean functions by using the basic Boolean properties. [BT-3]
5. To Able to optimize logic circuits using Karnaugh maps. [BT 5]
6. To analyze logic processes and implement logical operations using combinational logic circuits. [BT 4]
7. To understand concepts of sequential circuits and to analyze sequential systems in terms of state machines. [BT 4]

Text Books:

1. Morris Mano, “Digital Logic and Computer Design”, Pearson.

Reference Books:

1. Ronald J. Tocci, Gregory L. Moss, “Digital Systems”, 10 Ed, Pearson

2. D.C.Green, “Digital Electronics”5th Ed., Pearson, 2005

Subject: Design Thinking								
Program: B. Tech. EC Engg				**Subject Code: EC0322**			**Semester: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
1	0	2	2	40	40	60	60	200

Course Objectives:

1. To excite the student on creative design and its significance;
2. To make the student aware of the processes involved in design;
3. To make the student understand the interesting interaction of various segments of humanities, sciences and engineering in the evolution of a design;
4. To get an exposure as to how to engineer a design

COURSE CONTENT

UNIT-1 **[4]**

Introduction to Design Thinking

Design and its objectives; Design constraints, Design functions, Role of Science, Engineering and Technology in design; Engineering as a business proposition; Functional and Strength Designs. How to initiate creative designs? Initiating the thinking process for designing a product of daily use. Need identification; Problem Statement; Market survey- customer requirements; Design attributes and objectives; Ideation; Brain storming approaches; arriving at solutions; Closing on to the Design needs.

UNIT-2

Design process

Different stages in design and their significance; Defining the design space; Analogies and “thinking outside of the box”; Quality function deployment-meeting what the customer wants; Evaluation and choosing of a design. Design Communication; Realization of the concept into a configuration, drawing and model. Concept of “Complex is Simple”. Design for function and strength. Design detailing- Material selection,

UNIT-3

Prototyping

Rapid prototyping; testing and evaluation of design; Design modifications; Freezing the design; Cost analysis. Engineering the design, From prototype to product. Planning; Scheduling; Supply chains; inventory; handling manufacturing/ construction operations; storage; packaging; shipping; marketing; feed-back on design.

UNIT-4

Modular design

Design optimization; Design as a marketing tool; Intellectual Property rights – Trade secret; patent; copy-right; trademarks.

Course Outcomes:

1. Able to appreciate the different elements involved in good designs and to apply them in practice when called for.
2. Aware of the product oriented and user oriented aspects that make the design a success.
3. Will be capable to think of innovative designs incorporating different segments of knowledge gained in the course;
4. Students will have a broader perspective of design covering function, cost, environmental sensitivity, safety and other factors other than engineering analysis.

Text Books:

1. Balmer, R. T., Keat, W. D., Wise, G., and Kosky, P., Exploring Engineering, Third Edition: An Introduction to Engineering and Design - [Part 3 - Chapters 17 to 27]
2. Dym, C. L., Little, P. and Orwin, E. J., Engineering Design - A Project based introduction Wiley.
3. Pahl, G., Beitz, W., Feldhusen, J. and Grote, K. H., Engineering Design: A Systematic Approach, 3rd ed. 2007.

Reference Books:

1. Eastman, C. M. (Ed.), Design for X Concurrent engineering imperatives, 1996.
2. Haik, Y. And Shahin, M. T., Engineering Design Process, Cengage Learning.
3. Voland, G., Engineering by Design, Pearson publication

Web Resources:

1. http://opim.wharton.upenn.edu/~ulrich/designbook.html
2. http://www2.warwick.ac.uk/fac/sci/wmg/ftmsc/modules/modulelist/peuss/designfo rx/design_for_x_notes_s ection_5.pdf

List of Practical

1. To understand attributes of Design Thinking & Domain selection.
2. Observation through AEIOU - visit selected domain/place for getting insights and define problems. (Field activity)
3. Study and summarization of AEIOU activity/inputs.
4. Preparation of Mind Map
5. Preparation of Empathy Map
6. Systematic field exercises, empathization and Secondary Research activities -student teams need to define and validate their problem through the Ideation Phase.
7. Preparation of Ideation canvas.
8. Preparation of Product Development Canvas (PDC)
9. Customer/User Revalidation (Reject/Redesign/Retain) and Refinement of product Idea.
10. Preparation of a Rough Primary Prototype.

Subject:HUMAN VALUES AND PROFESSIONAL ETHICS								
Program: B. Tech. All Branches				**Subject Code: SS0301**			**Semester: III**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
2	0	0	2	0	0	100	0	100

Course Objectives:

1. To Facilitates arriving at correct decisions because, correct decisions form basis for Succes anywhere and in any venture.
2. To Decode Success.
3. To achieve Emotional stability through righteous earning of wealth.
4. To understand and discriminate between ethical and unethical practices.
5. To study moral issues and critical decision making.
6. To understand the role of ethics in promoting sustainable

Course Contents:

Music with invocation of thought process, Decoding success: Skill or a trait or both?, Decoding self to decode success, Understanding Self-Confidence, Self- respect, Self-esteem, False prestige towards removal of Identity crisis, Components of self (mind, body, spirit), Idea of self (Which of the three am I?), Mind and conscience, Psychosomatic (mind over matter) effect and dis-ease, Effect of ethics and values on well being, Handling insecurity, anxiety and pressure,Handling failures, guilt, Status and success, Success redefined., Happiness being the key to success and not vice-versa, From self to society to global-sustainability.

Course Outcomes:

1. Identify the ways to decode success and redefining it for global sustainability [BT-1]
2. Understand the Difference between the ethical and unethical practices in surrounding and explore the reasons behind them.[BT-2]
3. Apply correct decisions to form basis for success in all ventures of life [BT-3]
4. Analyse various components of self(mind, body, soul) [BT-4]
5. Estimate the Emotional stability through righteous earning of wealth [BT5]
6. Develop the thought process for promoting sustainable practices in multiple domains of life and society. [BT6]

Books:

1. The Mahabharata box set - Bibek Debroy, ISBN-13: 978-0143424789
2. The Valmiki Ramayana, Set of 3 Vols - Bibek Debroy, ISBN-13: 978-0143441144

3. Honest truth of dishonesty Dan Ariely, Harper (2012), ISBN: 0062183591 / 9780062183590
4. “Seven Spiritual Laws of Success”, Deepak Chopra, Amber-Allen Publisher, ISBN: 9782290339954
5. “The Vedas and Upanishads for Children”, Roopa pai,Hachette India, ISBN:9789351952961
6. The Gita : for Children - Roopa Pai, Hachette India Local; Latest edition, ISBN: 9789351950127
7. Go for Growth, Narsinhbhai K Patel, Ahmedabad Management Association
8. Be a Winner, Narsinhbhai K Patel, Ahmedabad Management Association
9. Swadharma: Puranic stories for children
10. Pearls of Wisdom from Hinduism – Nicholas Sutton and Hanuman Dass
11. The Power of Dharma: The Universal Moral Principle - Nicholas Sutton and Hanuman Dass
12. Two Vedic Tales: Stories from The Mahabharata and the Purana

SEMESTER-IV
SYLLABUS

Subject: **Microprocessor & Microcontroller**		
Program: **B.Tech (EC)**	Subject Code: EC0423	Semester: IV

Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	16/40	16/40	24/60	24/60	200

Course Objective:

By participating in and understanding all facets of this course a student will:

1) To introduce students to the architecture and operation of microprocessor & microcontrollers.
2) To familiarize students with programming of microcontroller.
3) To Introduce students to Embedded C programming
4) To familiarize students to interface various peripherals to the microcontroller.
5) To providing strong foundation for designing real world application using microcontroller.

Syllabus:

Unit	**Contents**	**Total Hours**
1	**Microprocessor Based Systems:** Microprocessor, Microcontroller, Von Neumann and Harvard Architecture, CISC and RISC Processors **8085 Microprocessor:** Architectural Block Diagram, Pin diagrams, Pin functions, Bus Organization, Internal operations and registers, Instruction set of 8085 processor	**10**
2	**8051 Microcontroller architecture:** Introduction to MCS -51 Family microcontrollers, Architectural block Diagram, Pin diagram, General Purpose and Special Function Registers, , Oscillator and clock circuit, Reset circuit, I/O Port circuits, Memory organization, Internal program and data memory, Introduction to program development tools **8051 Assembly language instructions :** Programming model of 8051, Addressing modes, data transfer instructions, I/O Port programming, Arithmetic and Logical instructions, Bit level instructions, Branching instructions (Jump and loop Jump and call), Concept of stack, subroutine and related instructions. **8051 Programming in C:Data types in 8051 C:** programming for time delay, I/O programming in 8051 C, Logic operations in 8051 C, Control statements and loops in embedded C, Functions and Arrays in embedded C, Data conversion programs in 8051 C, , Accessing code ROM space using 8051 C.	**10**

3	**8051 Timer/Counter and Programming:** Use of counter as timer, Timer/Counters and associated registers, Various modes of timer/counter operations, Time delay programs in Assembly language/ Embedded C. **8051 Serial Port and Programming:** Basics of serial communication, RS232 standards, 8051 connection to RS232, Serial data input/output and associated registers, Various modes of serial data communication, serial data communication programs in Assembly language/ Embedded C **8051 Interrupts: Concept of Interrupt:** interrupt versus polling, Types of interrupts in 8051, Reset, interrupt control and associated registers, interrupt vectors, Interrupt execution, RETI instruction, software generated interrupt, interrupt handler subroutine for timer/counter and serial data transmission/reception in Assembly language/ Embedded C	**10**
4	**Applications and design of microcontroller based systems:** Interfacing of LEDs, 7 Segment display device, LCD display, DIP Switches, Push Button switches, Interfacing A/D converter, D/A converter, Relay, opto isolator stepper motor and DC motor **Introduction to ARM Cortex-M processor:** Cortex- M processor family, Advantages of the Cortex-M processors, Applications of the ARM Cortex-M processors, Architecture of Cortex - M processor, Introduction to Instruction set and programming of ARM Cortex-M processor	**10**

Course Outcome:

After learning the course the students should be able to:

1. Apply the concept of buses, microprocessor architecture and interrupts.

2. Describe 8 bit microcontroller architecture-of MCS -51 family

3. Interface I/O devices with 8 bit/microcontroller

4. Program assembly language programming/ C programming of 8051

5. Design microcontroller based system

Text Books:

1. Microprocessor Architecture, Programming, and Applications with the 8085, By Romesh Gaonkar, Penram International Publishing (India) LTD.

2. The 8051 Microcontroller and Embedded Systems Using Assembly and C, 2/e by Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin McKinlay (Second Edition , Pearson Education)

3. The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors, by Joseph Yiu, Publisher: Elsevier, ISBN: 9789351071754, 9351071758

Reference Books:

1. The 8051 Microcontroller & Embedded Systems using Assembly and C By K. J. Ayala, D. V. Gadre (Cengage Learning , India Edition).

2. Using the MCS-51 Microcontrollers By Han Way Huang Oxford Uni Press

3. Programming and Customizing the 8051 Microcontroller by Myke Predko Tata Mcgraw Hill.

List of Experiments:

1. Introduction to IDE and Assembler directives.

2. 8051 Assembly language programming for addition, subtraction, multiplication and division of two 8-bit numbers .

3. 8051 Assembly language programming for block data transfer between internal and external memory including overlapping blocks.

4. 8051 Assembly language programming using Arithmetic instructions 5. 8051 Assembly language programming using Logical Instructions

6. 8051 Assembly language programming for code conversions

7. 8051 Assembly language programming for Timers in different modes.

8. I/O port programming in embedded C.

9. Timers and Counters programming in embedded C for time delay and frequency measurement using ISRs.

10. Digital clock programming using 7- segment display in embedded C.

11. Programming of LCD in embedded C.

12. Serial communication and UART programming in Embedded C.

Additional Materials:

1. Microcontroller Course (http://nptel.ac.in/courses/Webcoursecontents/IITKANPUR/microcontrollers/micro/ui/TOC.htm)

2. Microcontroller & Microprocessor Course:

https://nptel.ac.in/courses/108/105/108105102/

Subject: Linear Integrated Circuits								
Program: B. Tech. EC Engg				**Subject Code: EC0417**			**Semester: IV**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Outcomes :

After competing this course the student will be able to

- Understand operational amplifiers
- Able to select op-amp and other linear integrated circuits for specific application, and design circuits using the ICs
- Able to analyze circuits and determine their limitations

UNIT-I **[12]**

Operational Amplifier

Introduction, Parameters, Performance, datasheet, Frequency response, compensation, noise

UNIT-II **[12]**

Application of Op-Amp

DC amplifiers, difference amplifier, instrumentation amplifier, ac amplifier, current source and sink, current amplifier, DC voltmeter circuit, Ohmmeter circuit, Log and antilog amplifiers, Switching circuit with op-amp, voltage level detectors, Schmitt trigger, integrator and differentiators.

UNIT-III **[12]**

Signal Processing Circuits

Precision rectifiers, limiting circuits, clamping circuit, peak detectors, sample and hold circuits. Signal generation using 555 timer IC, VCO, Delay timers, sequential timers,

Pulse-tone oscillator, 7555 CMOS timer, IC function generators. Active filter design and analysis

UNIT-IV **[12]**

Voltage Regulators, Audio Power Amplifiers and Data converters

Voltage regulator basics, IC liner voltage regulators, switching regulators, Basics of audio amplifier, performance improvement of audio power amplifier, IC and MOSFET power amplifier, Basics of ADC and DAC

Course Outcomes:

1. To explain the op-amp's basic construction, characteristics, parameter limitations, various configurations and countless applications of op-amp.
2. To compare and select the various operational amplifier ICs using performance parameter given in the data sheets
3. To analyze basic op-amp circuits, particularly various linear and non-linear circuits, active filters, signal generators, and data converters
4. To design basic op-amp circuits, particularly various linear and non-linear circuits, active filters, signal generators, and data converters
5. To apply the concepts of op-amps and become proficient with computer skills (eg., Multisim) for the analysis and design of circuits
6. To create the analog circuit system for domestic applications

Text Books:

1. David A. Bell, "Operational Amplifier and Liner ICs", 3/e, Oxford University Press,

2. Ramakant Gayakwad "Op-amps and Linear Integrated Circuits", 4/e, PHI

Reference Books:

1. Sergio Franco "Design with Operational Amplifiers and Analog Integrated Circuits", Tata Mcgraw-hill 2009 Edition

2. D. Roy Choudhury and Shail B. Jain, "Linear Integrated Circuits", 3/e New Age International Publishers

3. R. Schaumann, and M E. Van Valkenburg, "Design of Analog Filers", Oxford University Press

Subject: Signals and Systems								
Program: B. Tech. EC Engg				**Subject Code: EC0418**			**Semester: IV**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	1	0	4	40	0	60	0	100

Course Outcomes :

- Understand about various types of signals, classify them, analyze them, and perform various operations on them
- Understand about various types of systems, classify them, analyze them and understand their response behavior.
- Change sampling rate of the signal
- Create strong foundation of communication and signal processing to be studied in the subsequent semester

UNIT-I **[12]**

- Overview: Signals, systems and signal processing,
- classification of signals,
- concept of frequency in continuous and discrete time signals,
- Periodic Sampling,
- Frequency domain representation of sampling,
- Reconstructions of band limited signals from its samples.

UNIT-II **[12]**

Linear Time Invariant systems

- Discrete time LTI systems Convolution,
- Continuous time LTI convolution,
- Properties of LTI systems, causal LTI systems describe by differential and difference equations,
- Impulse response ,
- Circular Convolution ,
- Correlation, Relation between convolution and correlation
- Freq. response of rational system functions relationship between magnitude & phase,
- All pass systems, inverse systems, Minimum/Maximum phase systems, systems with linear phase.

UNIT-III **[12]**

Fourier Series & Fourier Transform:

Fourier series representation of continuous time and discrete time periodic signals,

- Properties of Fourier series in continuous time and discrete time,
- Gibbs phenomenon
- Dirichlet's conditions,
- Fourier transform representation in continuous time and discrete time for aperiodic and periodic signals,
- Properties of Fourier transform in continuous time and discrete time, Time and frequency characterization of signals and systems ,
- Analysis of LTI discrete time system using discrete time Fourier transform ,
- Aliasing in frequency spectrum due to sampling

UNIT-IV **[12]**

Laplace Transform

- Review of Laplace transforms, Partial fraction expansion,
- Inverse Laplace transform,
- Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals,
- Properties of L.T's relation between L.T's, and F.T. of a signal.
- Laplace transform of certain signals using waveform synthesis
- Analysis of LTI continuous time system using Laplace Transform

Z–TRANSFORMS

- Concept of Z- Transform of a discrete sequence.
- Distinction between Laplace, Fourier and Z transforms.
- Region of convergence in Z-Transform, constraints on ROC for various classes of signals,
- Inverse Z-transform, properties of Z-transforms.
- Analysis of LTI continuous time system using Z-transform Transform
- Application of Z-transform

Text Books:

- 1. Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall
- 2. Signals & Systems by H P HSU, Second edition McGraw Hill Education.

Reference Books:

- Signals and Systems by A Nagoor Kani , Tata McGraw-Hill Education
- Signals and Systems by Anand Kumar ,Pearson publication.

Course Outcomes:

1. Apply the knowledge of linear algebra topics like vector space, basis, dimension, inner product, norm and orthogonal basis to signals.
2. Analyse the spectral characteristics of continuous-time periodic and a periodic signals using Fourier analysis.

3. Classify systems based on their properties and determine the response of LSI system using convolution.
4. Analyze system properties based on impulse response and Fourier analysis.
5. Apply the Laplace transform and Z- transform for analyze of continuous-time and discrete-time signals and systems.
6. Understand the process of sampling and the effects of under sampling.

Text Books:

1. Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall

2. Signals & Systems by H P HSU, Second edition McGraw Hill Education.

Reference Books:

1. Signals and Systems by A Nagoor Kani , Tata McGraw-Hill Education
2. Signals and Systems by Anand Kumar ,Pearson publication.

Subject: Digital System Design								
Program: B. Tech. EC Engg				**Subject Code: EC0419**			**Semester: IV**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
2	0	2	3	40	40	60	60	200

Course Objectives :

1. Design complex digital systems in HDL at different levels of abstraction
2. Partition a digital system into different subsystems
3. Transfer a design from a version possible to simulate to a version possible to synthesize
4. Identify principal parts in programmable circuits (PLD, FPGA, ASIC) and implement complex digital systems in programmable circuits

UNIT-I **[12]**

Basic Language Elements:

Identifiers, Data Objects, Data Types, Operators.

Behavioral Modeling:

Entity Declaration, Architecture Body, Process Statement, Variable Assignment Statement, Signal Assignment Statement, Wait Statement, If Statement, Case Statement, Null Statement, Loop Statement, Exit Statement, Next Statement, Assertion Statement

UNIT-II **[12]**

Dataflow and Structural:

Concurrent Signal Assignment Statement, Concurrent versus Sequential Signal Assignment, Delta Delay, Multiple Drivers, Conditional Signal Assignment Statement, Selected Signal Assignment Statement, Block Statement, Concurrent Assertion Statement, Component Declaration, Component Instantiation, generic and generate statements

UNIT-III **[12]**

Basics of Verilog:

Verilog as an HDL , Levels of design description, Concurrency, Simulation And Synthesis , Functional Verification ,System Tasks, Programming language Interface , Module

Gate Level Modeling: Gate level Primitives, Module structure, Instances of primitives, Delays models, Port types.

Modeling At Data Flow Level: Continuous assignment, Delays and continuous assignments, assignment to vectors, operators

UNIT-IV **[12]**

Behavioral Modeling: Operations and assignments, Procedures, Assignments with delays, Blocking and Non-blocking assignments, types of constructs, loops, Functions, Tasks and User-defined primitives.

Course outcomes:

1) To understand the constructs and conventions of the Verilog HDL programming. [BT 2]
2) To Analyze the structural, register-transfer level (RTL), and algorithmic levels of abstraction for modelling digital hardware systems. [BT 4]
3) Design a Verilog model for a combinational logic circuit using concurrent modeling techniques such as continuous assignment and logical operators [BT 6]
4) To Create the behavior of sequential logic circuits using Verilog procedural blocks. [BT 6]
5) To apply the concept of test-benches to evaluate testing behavioral environments for simulation-based verification. [BT 5]
6) To learn architecture of various reconfigurable devices. [BT 1]

Text Books:

1. J. Bhasker “A VHDL primer”, Prentice Hall

2. Samir Palnitkar “Verilog hdl: a guide to digital design and synthesis, second edition ”, Prentice Hall

Reference Books:

1. VHDL, Analysis and Modeling of Digital Systems by Navabi, Z. Second Edition, McGraw-Hill.
2. HDL Chip Design: A Practical Guide for Designing, Synthesizing & Simulating Asics & Fpgas Using VHDL or Verilog " by Douglas J. Smith

Program: **B. Tech in EC Engineering**				Subject Code: BB0311			Semester: **IV**	
Teaching Scheme (Hours per week)				**Examination Evaluation Scheme (Marks)**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
2	0	0	2	40	0	60	0	100

Course Objectives

1. Techniques relating to managing engineering activities, engineer's transition into management, engineering managerial functions, motivation of individual and group behavior.
2. Productivity assessment/improvement.
3. Managing the quality function and communications.

CONTENTS

UNIT-I

[7 hours]

Meaning, importance, skills and roles of manager, different levels of management. Functions of management, planning: nature, importance, steps, Organising: Meaning, process, principles of organizing, staffing:-manpower planning, recruitment, selection, placement.

UNIT-II

[7 hours]

Leadership and Organizations Management, Strategic Planning, Budgeting, Project Planning - Risk Identification, Assessment and Response Planning

UNIT-III

[7 hours]

Management of Technology, Product Development and Innovation, Technical Entrepreneurship, Global Trade and International Operations, Operations Management

UNIT-IV

[7 hours]

Marketing Management:-the 4 p's of marketing, demand forecasting (concepts only), market segmentation. Financial management:-meaning, scope, functions, objectives, role of financial manager. Lean Systems, Intellectual Property, Legal Issues in Engineering Management, Principles of Ethics for Engineering Managers

Course Outcomes

1. Able to know, comprehend, apply, analyze, synthesize and evaluate the basic principles of the fundamentals of managing technical organizations.

2. Prepare for further study in the area of engineering technology management.

3. Able to identify and apply appropriate management techniques for managing contemporary organizations.

4. Have an understanding of the skills, abilities, and tools needed to obtain a job on a management track in an organization of their choice.

Text Books

1. Principles of Management by PC Tripathi & Reddy.
2. Management –I by Stephen P. Robbins& Stoner.
3. Management-II BY Kotler,Stoner

Reference Books

1. L. M. Prasad; Principles of Management; Sultan Chand and Sons
2. Karminder Ghuman and K. Aswathapa; Management – Concept

SEMESTER-V
SYLLABUS

Subject: Principles of Communication Systems								
Program: B. Tech. EC Engg				**Subject Code:** EC0516			**Semester: V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	40	0	60	0	100

Course Objectives

1. To understand how the information transfers over a longer distance and different techniques involved in such communication.
2. To analyze system requirements of analog communication systems.
3. To understand the need for modulation.
4. To understand the generation and detection of various analog modulation techniques with mathematical analysis.
5. To analyze the noise performance of analog modulation techniques.
6. To provide theoretical knowledge of each block in AM and FM receivers.

CONTENTS

UNIT-I

[12 hours]

Introduction to Signals: Types of Signals, Signals and Vectors, Signal comparison using correlation, Orthogonal signal set, Fourier Series, Analysis and Transmission of Signals using Fourier Transform, Signal transmission through linear system.

Communication System: Analog and Digital Messages, Parameters of Communication systems: Signal-to-ratio, Channel Bandwidth, Transmission Bandwidth, Signal Bandwidth, Rate of Communication, Modulation, Redundancy and Coding, Application of Communication Systems

UNIT-II

[12 hours]

Amplitude Modulation: Baseband and Carrier Modulation, Double side band, Double Side band Suppressed Carrier, Amplitude Modulation (AM), Quadrature Amplitude Modulation(QAM), Single Side Band (SSB), Vestigial Side Band (VSB)

Angle Modulation: Concept of instantaneous frequency, Bandwidth of angle modulated wave, Generation of FM waves, Demodulation of FM, Phase Modulation, Comparison of AM and FM.

UNIT-III

[11 hours]

Noise: Introduction, Thermal Noise, Shot Noise, Partition, Noise, Flicker Noise, Performance of AM systems in presence of Noise, Performance of Angle modulated systems in presence of Noise, Pre-emphasis and De-emphasis

UNIT-IV

[10 hours]

Receivers: Super heterodyne Receiver, Tracking, Tuning, Sensitivity, Gain, Image Rejection, AGC, Adjacent channel selectivity, FM receiver, Recent Trends and Development in Analog Communication: Applications of AM, FM and PM, FM Broadcast Radio, Frequency Stabilizers

Course Outcomes

1. Understand how the information transfers over a longer distance and different techniques involved in such communication.
2. Analyze system requirements of analog communication systems.
3. Understand the need for modulation.
4. Understand the generation and detection of various analog modulation techniques with mathematical analysis.
5. To analyze the noise performance of analog modulation techniques.
6. Provide theoretical knowledge of each block in AM and FM receivers.

Text Books:

1. Modern digital and analog Communication systems, B. P. Lathi, Oxford University Press, 4th Ed, 2010.
2. Electronic Communications, Dennis Roddy and John Coolen, Pearson, 4th edition, 2011.

Reference Books:

1. Taub & Schilling: Principles of Communication Systems, Tata McGraw-Hill

2. Leon W.Couch, II: Digital and Analog Communication Systems, Pearson, Education (Seventh Edition)

Subject: Electromagnetics								
Program: **B.Tech. Electronics & Communication Engineering**				Subject Code: EC0517			Semester: **IV**	
Teaching Scheme (Hours per week)				**Examination Evaluation Scheme (Marks)**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)-Theory**	**Continuous Internal Evaluation (CIE)-Practical**	**Total**
3	2	0	4	24/60	0	16/40	0	100

Course Objectives

1. To determine electric and magnetic fields
2. To relate the physical basis of Maxwell's equations in integral form and differential form, and apply them for the solution of appropriate problems involving static as well as time varying fields.
3. To acquire basic knowledge of Uniform plane waves.

CONTENTS

UNIT-I

[7 hours]

Vector Analysis
Scalars & Vectors, Dot and Cross products, Co-ordinate systems and conversions.

Electrostatics I
Coulomb's law, Electric field intensity, Concept of electric flux density, Gauss's law and its applications, Differential volume element, Divergence, Maxwell's first eqn. and divergence theorem.

UNIT-II

[11 hours]

Electrostatics II
Conductor properties & boundary conditions, boundary condition for perfect dielectric materials, Poisson's and Laplace equation, Uniqueness theorem, Examples.

UNIT-III

[12 hours]

Steady magnetic field
Biot-Savart's law, Ampere's circuital law, Point form of Ampere's circuital law, concept of flux density, Scalar and vector magnetic potential, Stoke's theorem for magnetic field

Time Varying Fields and Maxwell's Equations
Faraday's law, Displacement current, Maxwell's equations in point and integral forms for time

varying fields

UNIT-IV

[12 hours]

The Uniform Plane Wave

The wave equation, wave motion in free space, waves motion in perfect dielectric, Plane waves inside the lossy matter, Poynting vector and Wave power, Propagation in good conductor, Phenomena of skin effect, Reflection of uniform plane waves.

Course Outcome

1. Solve the problems on dot product, cross product and co-ordinate systems & conversion. [BT 5]
2. Apply vector calculus to understand the behavior of static electric fields in standard configurations. [BT 2,3]
3. Apply vector calculus to understand the behavior of static magnetic fields in standard configurations. [BT 2,3]
4. Describe and analyze electromagnetic wave propagation in free-space based on Maxwell's equation. [BT 1]
5. Analyze the uniform plane wave motion in good conductors, perfect dielectric and inside lossy material. [BT 4]
6. Design analysis of the RF components (transmission line & waveguide) based on Maxwell's Equations. [BT 6]

Text Books

1. Engineering Electromagnetics, W H Hayt, J A buck, 7th Edition, TMH Publication

Reference Books

1. Electromagnetic Waves & Radiating Systems, Edward C. Jordan, Keith G. Balmain, 2nd Edition, PHI publication.
2. Fields and Waves in Communication Electronics, Simon Ramo, John R. Whinnery, Wiley Publication

Web Resources

1. http://nptel.ac.in/courses/115101005/
2. http://nptel.ac.in/courses/108104087/
3. http://nptel.ac.in/courses/117103065/
4. ece3300+smith chart

Subject: Python programming								
Program: B. Tech. EC Engg				**Subject Code: EC0525**			**Semester: V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Objectives:

1. Importance of Python as a scientific computing tool which directly leads to employability.
2. To learn how to design and develop Python applications.
3. Skill development to apply mutable and immutable types.
4. To learn how to design object oriented concepts in python.
5. Development of GUI based applications for entrepreneurship.

CONTENTS

UNIT-I

[12 hours]

Informal introduction to programming, algorithms and data structures via gcd, Downloading and installing Python, gcd in Python: variables, operations, control flow - assignments, condition-als, loops, and functions. Python: types, expressions, strings, lists, tuples. Python memory model: names, mutable and immutable values List operations: slices etc Binary search , Inductive function definitions: numerical and structural induction ,Elementary inductive sorting: selection and insertion sort,In-place sorting.

UNIT-II

[12 hours]

Basic algorithmic analysis: input size, asymptotic, complexity () notation ,Arrays vs lists ,Merge sort ,Quicksort, Stable sorting. Dictionaries More on Python functions: optional arguments, default values, Passing functions as arguments , Higher order functions on lists: map, list comprehension. Exception handling ,Basic input/output ,Handling files , String processing..

UNIT-III

[12 hours]

Backtracking: N Queens, recording all solutions, Scope in Python: local, global, nonlocal names, Nested functions, Data structures: stack, queue, Heaps. Abstract data types, Classes and objects in Python ,"Linked" lists: find, insert, delete , Binary search trees: find, insert, delete , Height-balanced binary search trees. Array computing and curve plotting, vectors and

higher-dimensional arrays, matrices, numPy, sciPy and Matplotlib, Plotting using PyLab, Chat Application, Graphics and GUI Programming – Drawing using Turtle, Tkinter.

UNIT-IV

[12 hours]

Python Pandas - Data alignment, aggregation, summarization, computation and analysis with Pandas. Scientific computation using Python - Statistical data analysis, image processing,

Course Outcomes:

At the end of this subject, students should be able to:

1. Work with the Python standard libraries.
2. Implement mutability for various elements of Python.
3. Develop GUI based projects.
4. Design Networking configuration for chatting applications.
5. Implement Scientific Computing.
6. Solve real world problems using Python programming.

Text Books:

1. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India
2. Hans Petter Langtangen, A Primer on Scientific Programming with Python

Reference Books:

1. Claus Fuhrer, Jan Erik Solem, Olivier Verdier, Scientific Computing with Python 3,Packt Publishing Limited
2. Martin C. Brown, Python: The Complete Reference, McGraw Hill Education R. Nageswara Rao, “Core Python Programming”, dreamtech
3. Wesley J. Chun. “Core Python Programming - Second Edition”, Prentice Hall
4. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, Wiley
5. Kenneth A. Lambert, “Fundamentals of Python – First Programs”, CENGAGE Publication

Web Resources:

1. https://www.edx.org/course/introduction-to-computer-science-and-programming-using-python-2
2. http://www.openculture.com/2017/05/learn-python-with-a-free-online-course-from-mit.html
3. https://www.edx.org/course/introduction-to-python-absolute-beginner-3
4. https://onlinecourses.nptel.ac.in/noc19_cs40

LIST OF EXPERIMENTS

Experiment. No.	Title	Learning Outcomes
1.1	Write a Python program to print the calendar of a given month and year.	CO1
1.2	Write a Python program to calculate number of days between two dates.	CO1
1.3	Write a Python program to check whether a specified value is contained in a group of values. *Test Data* : 3 -> [1, 5, 8, 3] : True -1 -> [1, 5, 8, 3] : False	CO1
1.4	Write a Python program to get OS name, platform and release information.	CO1
2.	**Mutable and Immutable types**	
2.1	Write a Python program which accepts a sequence of comma-separated numbers from user and generate a list and a tuple with those numbers.	CO2
2.2	Write a Python program to display the first and last colors from the following list.[orange, purple, red,yellow,blue]	CO2
2.3.	Write a Python program to concatenate all elements in a list into a string and return it.	
2.4	Write a Python program to print out a set containing all the colors from color_list_1 which are not present in color_list_2. *Test Data* : color_list_1 = set(["White", "Black", "Red"]) color_list_2 = set(["Red", "Green"]) *Expected Output* : {'Black', 'White'}	CO2
2.5	Write a Python script to print a dictionary where the keys are numbers between 1 and 15 (both included) and the values are square of keys. Sample Dictionary {1: 1, 2: 4, 3: 9, 4: 16, 5: 25, 6: 36, 7: 49, 8: 64, 9: 81, 10: 100, 11: 121, 12: 144, 13: 169, 14: 196, 15: 225}	CO2
2.6	Write a Python program to print all unique values in a dictionary. Sample Data : [{"V":"S001"}, {"V": "S002"}, {"VI": "S001"}, {"VI": "S005"}, {"VII":"S005"}, {"V":"S009"},{"VIII":"S007"}] Expected Output : Unique Values: {'S005', 'S002', 'S007', 'S001', 'S009'}	CO2
3.	**Data Structures, RE and Plots**	

3.1	Develop programs for data structure algorithms using python – searching, sorting and hash tables.	CO5
3.2	Write a Python Program that searches a string to see if it starts with "The" and ends with "Indus".	CO1
3.3	Write a Python Program that returns a match where the string contains a white space character.	CO1
3.4	Write a Python program that matches a string that has an a followed by three 'b'.	CO1
3.5	Develop chat room application using multithreading.	CO4
3.6	Perform basic plotting using the randomly generated data to plot graph using series and matplotlib.	CO1
3.7	Generate different types of bar plot and Pie plot to understand behavior of given data.	CO1
4	**Tkinter, turtle, flask**	
4.1	Create (1) Registration form (2) Quiz form using tkinter.	CO3
4.2	Draw (1) Square (2) Rectangle (3) Star patterns using Turtle.	CO3
4.3	Basics of Flask.	CO3
4.4	Basics of Tensor flow.	CO3
5.	**Numpy**	
5.1	Practicals based on Numpy statistical analysis.	CO5
6.	**Pandas**	
6.1	Practicals based on Pandas	CO1

Subject: Sensors and Transducers								
Program: B. Tech. EC Engg				**Subject Code: EC0519**			**Semester: V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Objectives

1. To make students familiar with the constructions and working principle of different types of sensors and transducers.
2. To make students aware about the measuring instruments and the methods of measurement and the use of different transducers.

CONTENTS

UNIT-I [10 hours]

Mechanical and Electromechanical sensor: Definition, principle of sensing & transduction, classification. Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity. Strain gauge: Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature, adhesive, rosettes.

Inductive sensor: common types ,Reluctance change type, Mutual inductance change type, transformer action type, Magnetostrictive type, brief discussion with respect to material, construction and input output variable, Ferromagnetic plunger type, short analysis. LVDT: Construction, material, output input relationship, I/O curve, discussion. Proximity sensor

UNIT-II [12 hours]

Capacitive sensors: Variable distance-parallel plate type, variable area- parallel plate, serrated plate/teeth type and cylindrical type, variable dielectric constant type, calculation of sensitivity. Stretched diaphragm type: microphone, response characteristics. Piezoelectric element: piezoelectric effect, charge and voltage co-efficient, crystal model, materials, natural & synthetic type, their comparison, force & stress sensing, ultrasonic sensors.

UNIT-III [13 hours]

Thermal sensors: Material expansion type: solid, liquid, gas & vapor Resistance change type: RTD materials, tip sensitive & stem sensitive type, Thermister material, shape, ranges and accuracy specification. Thermo emf sensor: types, thermoelectric power, general consideration, Junction

semiconductor type IC and PTAT type. Radiation sensors: types, characteristics and comparison. Pyroelectric type.

UNIT-IV [10 hours]

Magnetic sensors: Sensor based on Villari effect for assessment of force, torque, proximity, Wiedemann effect for yoke coil sensors, Thomson effect, Hall effect, and Hall drive, performance characteristics. Radiation sensors: LDR, Photovoltaic cells, photodiodes, photo emissive cell types, materials, construction, response. Geiger counters, Scintillation detectors, Accelerometer, Gyrometer, GPS

Course Outcomes

1. Use concepts in common methods for converting a physical parameter into an electrical quantity
2. Classify and explain with examples of transducers, including those for measurement of temperature, strain, motion, position and light
3. Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc

Text Books

1. Sensor & transducers, D. Patranabis, 2nd edition, PHI

Reference Books

1. Instrument transducers, H.K.P. Neubert, Oxford University press.
2. Measurement systems: application & design, E.A.Doebelin, McGraw Hill

Subject: Advanced Electronics								
Program: B. Tech. EC Engg				**Subject Code: EC0526**			**Semester: V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Objectives

- Analyse the various biasing techniques using JFET/MOSFET,Design the biasing techniques for applications using JFET/MOSFET.
- Analyse the various single tuned ,double tuned and stagger tuned amplifiers,
- Explain the effect of various tuned amplifiers on bandwidth
- Compare the various optoelectronic devices,Analyse and design the CMOS Opamp

CONTENTS

UNIT-I

[12 hours]

Tuned Amplifier

Tuned amplifier Q factor,small signal tuned amplifier,Effect of cascading single tuned amplifiers on bandwidth,Effect of cascading double tuned amplifiers on bandwidth,Stagger tuned amplifier,comparison of tuned amplifiers,large signal tuned amplifiers,Stability of tuned amplifier,Neutralization.

UNIT-II

[12 hours]

Design using FETs

JFET biasing techniques, fixed biasing technique ,voltage divider bias,self bias,Trans conductance and drain curves,CS,CD,CG amplifiers MOSFET amplifiers, comparison of MOSFET amplifiers,MOSFET biasing techniques

UNIT-III

Design of CMOS operational amplifier **[12hours]**

OPamp Specifications,Design Approach and stability,Two stage op amps, Compensation,folded cascode theory, common mode feedback, oscillators amplifiers in negative feedback

UNIT-IV

[12hours]

Opto-electronic Devices spectral response of human eye, photo- conductive sensors, photo-voltaic sensors, photo-emission sensors,light emitters,LCD,Nixie,tube, Alphanumeric Displays,LCD pannels,plasma display panels, Opto-couplers Introduction to memories, semiconductor memories.

Course Outcomes

1. To design the circuits using MOSFET, Tuned Amplifier,optoelectronics devices
2. To Construct the circuit and make project using the above said components
3. Compare the various optoelectronic devices,Analyse and design the CMOS Opamp
4. Students will be able to analyse the various single tuned ,double tuned and stagger tuned amplifiers,
5. Students will be able to explain the effect of various tuned amplifiers on bandwidth

Text Books

Electronics Devices and Circuits by S Salivahanan And N Suresh kumar Tata Macgrohil.3rd Edition

Reference Books

Design of CMOS Operational Amplifiers by Rasoul Dehghani Artech House,

Web Resources

NPTEL video lecture series on Analog CMOS VLSI Design. Video course on Tuned amplifier

Subject: System Verilog for verification								
Program: B. Tech. EC Engg				**Subject Code: EC0527**			**Semester: V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Objectives:

- The main objective of this course is to learn to design a testbench for verification of digital designs using systemverilog.
- This course provides methods and guidelines to design an effective testbench for digital designs.
- The information on basic components, required to design a testbench, are covered in this course.

CONTENTS

Unit 1 **[10 hours]**

VERIFICATION GUIDELINES

- Introduction
- The Verification Process
- The Verification Plan
- The Verification Methodology Manual
- Basic Testbench Functionality
- Directed Testing
- Methodology Basics
- Constrained-Random Stimulus
- What Should You Randomize?
- Functional Coverage
- Testbench Components
- Layered Testbench
- Building a Layered Testbench
- Simulation Environment Phases
- Maximum Code Reuse
- Testbench Performance

DATA TYPES

- Built-in Data Types
- Fixed-Size Arrays
- Dynamic Arrays
- Queues

- Associative Arrays
- Linked Lists
- Array Methods
- Choosing a Storage Type
- Creating New Types with typedef
- Creating User-Defined Structures
- Enumerated Types
- Constants
- Strings
- Expression Width
- Net Types

Unit 2 **[13 hours]**

PROCEDURAL STATEMENTS AND ROUTINES

- Procedural Statements
- Tasks, Functions, and Void Functions
- Task and Function Overview
- Routine Arguments
- Returning from a Routine
- Local Data Storage
- Time Values

BASIC OOP

- OOP Terminology
- Creating New Objects
- Object Deallocation
- Using Objects
- Static Variables vs. Global Variables
- Class Routines
- Defining Routines Outside of the Class
- Scoping Rules
- Using One Class Inside Another
- Understanding Dynamic Objects
- Copying Objects
- Public vs. Private

Unit 3 **[13 hours]**

CONNECTING THE TESTBENCH AND DESIGN

- Separating the Testbench and Design
- The Interface Construct
- Stimulus Timing
- Interface Driving and Sampling
- Connecting It All Together
- Top-Level Scope
- Program – Module Interactions
- SystemVerilog Assertions
- The Four-Port ATM Router

THREADS AND INTERPROCESS COMMUNICATION

- Working with Threads
- Interprocess Communication
- Events
- Semaphores
- Mailboxes
- Building a Testbench with Threads and IPC

Unit 4 **[10 hours]**

ADVANCED OOP AND GUIDELINES

- Introduction to Inheritance
- Factory Patterns
- Type Casting and Virtual Methods
- Composition, Inheritance, and Alternatives
- Copying an Object
- Callbacks

FUNCTIONAL COVERAGE

- Coverage Types
- Functional Coverage Strategies
- Simple Functional Coverage Example
- Anatomy of a Cover Group
- Triggering a Cover Group
- Data Sampling
- Cross Coverage
- Coverage Options
- Parameterized Cover Groups
- Analyzing Coverage Data
- Measuring Coverage Statistics During Simulation

Course Outcomes

At the end of this course student will be able to:

1. Understand coverage-driven random testing in a layered test-bench environment.
2. Understand new SystemVerilog data types such as arrays, structures, enumerated types, and packed variables and Procedural Statements and Routines.
3. Design OOP to build classes, construct objects, and use handles.
4. Create multiple threads in your testbench, use interprocess communication to exchange data between these threads and synchronize them.
5. Understand different types of coverage and how you can use functional coverage to measure your progress as you follow a verification plan.

Text Books:

1. SystemVerilog for Verification: A Guide to Learning the Testbench Language Features by Spear Chris and Tumbush Greg.

Reference Books:

2. SystemVerilog Assertions and Functional Coverage by Guide to Language, Methodology and Applications by Ashok Mehta

Subject: Digital Signal Processing								
Program: B. Tech. EC Engg				**Subject Code: EC0522**			**Semester: V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Outcomes:

After completing this course the student will be able to

1. Formulate engineering problems in terms of DSP tasks
2. Design digital filters
3. Conceptualize the need of adaptive filters in communication applications
4. Understand the key Architectural features of Digital Signal Processor
5. Apply digital signal processing algorithms to various areas

Unit No.	Topics
1	**DFT & FFT** • Introduction of DFT • Matrix relation for computing DFT and IDFT • DFT Properties • Relation between DFT and other transform • Comparison between linear and circular convolution Application of DFT • Introduction to FFT • Radix 2 FFT algorithm (DIT) • Radix 2 FFT algorithm(DIF) • IFFT • Linear filtering approach to computation of DFT • Quantization error
2	**IIR Filter design** • Introduction of Structure for IIR system • Direct form • Cascade form • Parallel • Lattice Structure

	● Introduction to digital filter ● IIR filter design ● Impulse invariant ● Bilinear ● Matched Z transformation ● Design Butterworth filter ● Design chebyshev filter ● Designing Highpass, bandpass and bans stop filter
3	**FIR filter design** ● Structure of FIR systems ● Direct form , Cascaded form ● Lattice structure, Transposed structure ● Introduction of FIR filter ● FIR filter design & specification ● FIR filter design using windows ● FIR filter design using DFT method ● FIR filter design using sampling method ● Quantization error
4	**DSP Processor** ● Introduction of DSP processor ● Von Neumann model ● Hardward Architecture ● Texas Instrument's TMS320 family ● Comparison of Microprocessor with DSP processor ● Application of DSP **Advance DSP Techniques:** ● **Multirate Signal Processing:** Decimation, Interpolation, Sampling rate conversion by rational factor ● **Adaptive filters:** Introduction, Basic principles of Forward Linear Predictive filter and applications such as system identification, echo cancellation, equalization of channels, and beam forming using block diagram representation study only.
Text books:	John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth edition, Pearson education / Prentice Hall, 2007
Reference Books/Notes	Alan V.Oppenheim, Ronald W. Schafer & Hohn. R.Back, "Discrete Time Signal Processing", Pearson Education, 2nd edition, 2005 Digital Signal Processors, Architecture, programming and applications by B. Venkatramani, M Bhaskar, Mc-Graw Hill Fundamentals of digital Signal Processing –Lonnie c.Ludeman, Wiley

Subject: Entrepreneurship Development								
Program: B. Tech. EC Engg				**Subject Code:**			**Semester: V**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
2	0	0	2	40	0	60	0	100

Course Objective:

1. To introduce the concept of Entrepreneur and Entrepreneurship in the mind of participants with reference to the process of economic and industrial development of the country.
2. To involve participants in relevant interrelated field based project work or studies of entrepreneurs' promotional policies of the government and other developmental agencies, financial institutions including banks and central government policies to develop target group as entrepreneurs.

Course Content:

Unit-I **[8 HOURS]**

· Entrepreneur and Entrepreneurship
· Indian entrepreneurship
· Women Entrepreneurship

Unit-II **[8 HOURS]**

· Factors Affecting Entrepreneurship Growth
· Entrepreneurship Motivation
· Entrepreneurship Competencies

Unit-III **[6 HOURS]**

· Micro and Small Enterprises
· Opportunity Identification and Selection
· Formulation of Business Plans
· Project Appraisal.

Unit-IV

· Financing of Enterprise

· Forms of Business Ownership

· Institutional Finance to Entrepreneurs

Course Outcome:

1. Understanding of various aspects related to entrepreneurship.
2. To understand the process of Entrepreneurial process and decisions as typical managerial decision.

Text Books:

1. Entrepreneurial Development by Dr. S.S. Khanka S Chand Publication
2. Entrepreneurship Development (Obstacles & Solutions) by Dipesh D. Uike Himalaya Publication

Reference Books:

1. Entrepreneurship Management: By ArunaKaulgud
2. Essentials of Entrepreneurship & Small Business Management: By Thomas & Norman
3. Dynamics of Entrepreneurship & Management: By Vasant Desai.
4. Entrepreneurship: Resources & Strategies: by Marc J. Dollinger

SEMESTER-VI
SYLLABUS

Subject:VLSI Design								
Program: B. Tech. EC Engg				**Subject Code: EC0616**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Outcomes:

- Calculate the R-C delay of different gate using Elmore's delay method. [BT 2]
- Analyze and optimize the delay of the critical data path using logical effort technique. [BT 3, 4, 5]
- Design complex logic gates using different logic styles like CMOS, Pass Transistor Logic, and Transmission Gate etc. [BT-4, 6]
- Design and implement the combinational circuits and sequential circuits at transistor level. [BT 6]
- Test the different designs stuck at faults and learn the different methods for testing. [BT 2, 4, 6]

UNIT-I **[12]**

Introduction to VLSI

Introduction, NMOS/PMOS manufacturing, CMOS process steps, Physics of MOS, characteristics of the MOSFET, Threshold voltage, gradual channel approximation, channel length modulation, Scaling of MOSFET, Short channel effects, Narrow channel effects, Latch-up and its prevention in CMOS, SPICE model of MOSFET, Physical design of MOSFET in CAD

UNIT-II **[10]**

MOS Inverters : Dynamic and Static characteristics

Resistive load inverters, CMOS inverters, Analysis, design, Power consumptions in inverters, Interconnects and parasitic assisted handoff and soft handoff, Introduction to dropped call rate, Formula of dropped call rate

UNIT-III **[10]**

MOS Logic Circuits

Introduction, Combinational MOS Logic Circuits, Sequential MOS Logic circuits, Dynamic Logic Circuits, CMOS Transmission Gates, Schmitt trigger circuits, Voltage Bootstrapping, Pass transistor circuits, High performance CMOS dynamic circuits, Low-power CMOS Logic circuits.

UNIT-IV **[11]**

Sequential MOS Logic Circuits :

Introduction, Behavior of Bi-stable elements, The SR latch circuit, Clocked latch and Flip-flop circuit, CMOS D-latch and Edge-triggered flip-flop

Design for testability:

Introduction, Fault types and models, Controllability and observability, Ad Hoc Testable design techniques, Scan –based techniques,

Text Books:

1. CMOS Digital Integrated circuits – Analysis and Design by Sung – Mo Kang, Yusuf Leblebici,TATA McGraw-Hill Pub. Company Ltd., Third Edition.

Reference Books:

1. Basic VLSI Design By Pucknell and Eshraghian, PHI,3rd ed.
2. Introduction to VLSI Circuits & Systems – John P. Uyemura

Subject:Data communication and Networks								
Program: B. Tech. EC Engg				**Subject Code: EC0617**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
2	0	2	3	40	40	60	60	200

Course Outcomes:

After completing this course the student will be able to

1. · Evaluate the performance parameters of electronic and communication systems
2. · Prepare test plans to verify the specifications
3. · Design test procedures for verification of system/sub-system specifications
4. · Design custom test instruments

UNIT-I **[10]**

Introduction: Internet, Network Edge, Network performance in switching network, protocol layers and service models, history of computer network in internet.

Network services and applications: Principles of network applications, The web and HTTP, E mail in the internet, DNS, peer-to-peer systems, socket programming with TCP and UDP.

UNIT-II **[13]**

Transport Layer: introduction to transport layer, principles of reliable data transfer, Connectionless and connection oriented transport, principles of congestion control, TCP congestion control,

Network Layer: Introduction, virtual circuits and data gram networks, Internet Protocol: Addressing and forwarding, Routing Algorithms, intra-domain and inter-domain routing algorithms, broadcast and multicast routing.

UNIT-III **[13]**

Link layers and local area networks: Introduction, framing techniques, error detection and correction techniques, multiple access protocols, Addressing, Ethernet Link layer switches, PPP, link virtualization: A network as a link layer, Data flow in computer network

UNIT-IV **[12]**

Network security: Introduction, principle of cryptography, message integrity, security in various layers, operational security, Summary of Physical layer

Text Books:

James F. Kurose and Keith W. Ross. Computer Networking - A Top Down Approach, Addison-Wesley. (Fifth Edition or higher)

Reference Books:

1. Computer Networks: A Systems Approach, by L Peterson and B Davie.
2. Advanced Programming in the UNIX Environment, by Stevens and Rago.
3. Data Networks by Dimitri P Bertsekas, Robert Gallager.

Subject:Digital Communication								
Program: B. Tech. EC Engg				**Subject Code: EC0618**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Outcomes:

1. On successful completion of this course student will be able to Study representation of signals and discuss the process of sampling, quantization and coding.
2. Understand baseband and band pass signal transmission and reception techniques.
3. Learn error control coding for the encoding and decoding of digital data streams over noisy channels for their reliable transmission.
4. Design variable length codes for a given message source to increase efficiency.

UNIT-I **[12]**

Introduction to Digital Communication Systems, Communication System Model, Typical Digital communication System, Advantage of Digital communication

Probability and random process

Information, Probability, Random Variables, Mean and variance, Conditional Probability of independent events, Relation between probability and probability Density , Rayleigh Probability Density , CDF, PDF, Random Variables, correlation between Random Variables, Linear mean square Estimation, Central limit theorem, Error function and Complementary error function Discrete and Continuous Variable, Gaussian PDF, Threshold Detection, Statistical Average,Chebyshev In Equality, Autocorrection.

UNIT-II **[10]**

Information Theory :

Introduction, Concept & Measure of information, statistics of discrete channel, Error Free Communication Over a noisy channel, Shannon Theorem, The channel capacity of a Discrete Memory less Channel, Optimum System, The channel capacity of a Continuous Channel, Source Coding.

Error Control Coding:

Introduction, Linear block code, cyclic code, convolution code, Burst Error Correcting and detecting code

UNIT-III **[10]**

Base Band Modulation :

PAM Signals, Digital multiplexing ,line coding,Digitizing Analog signals sampling,Quntization,Encoding, Alising, Nyquist first and second criterion for zero ISI, PCM, DPCM, ADPCM, Uniform and Non-uniform Quantization, Quantization Error in PCM,Delta Modulation, Adaptive Delta Modulations ,SNR Calculation, Non-uniform Quantization

UNIT-IV **[11]**

Digital Modulation Techniques :

QAM, BPSK, QPSK, DPSK, MSK, M-ary-FSK, M-ary-PSK, BFSK of various digital modulation techniques and scrambling

Digital Demodulation Techniques:

Coherent and non-coherent detection of ASK, FSK, PSK, QPSK,DPSK. Noise Figure, Signal to noise Ratio, performance of communication system with channel noise.

Text Books:

1. Digital Communication-Theory, Techniques and Applications by R. N. Mutagi, 2nd edition, OXFORD university press.

2. Digital and analog communication system by B.P.Lathi .Zhi Ding (international 4th Edition), OXFORD university press.

Reference Books:

1. An Introduction to Analog and Digital Communications by Simon Haykin, Wiley India.

2. Principle of communication system by Taub . Schilling (2nd Edition), TATA McGRAW-HILL.

3. Digital Communications by Simon Haykin, Wiley India

Subject: **Microwave & Radar Engineering**								
Program: **B.Tech. Electronics & Communication Engineering**				Subject Code: EC0624			Semester: VI	
Teaching Scheme (Hours per week)				**Examination Evaluation Scheme (Marks)**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)-Theory**	**Continuous Internal Evaluation (CIE)-Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Objectives

1. To obtain an understanding of transmission lines & waveguides.
2. To gain the knowledge of the different microwave passive components and to evaluate their S-parameters.
3. Study of the different microwave semiconductor devices and microwave tubes.
4. Design and analysis of advanced forms of waveguides such as Substrate integrated waveguide and corrugated waveguide using HFSS software.
5. To acquire the knowledge of the latest radar & navigation systems.

CONTENTS

UNIT-IV

[12 hours]

Introduction to RF & Microwave Engineering

Definitions, IEEE defined microwave bands, Microwave history and applications, advantages & disadvantages of microwaves, Review of Set of Maxwell's equations & Helmholtz's plane wave equation.

Transmission lines

Lumped-element circuit model for a transmission line, the transmission line equations, terminated lossless transmission lines, Voltage standing wave ratio & Reflection co-efficient, Input impedance of finite length transmission line, Smith chart and impedance matching, , Co-axial line, Stripline, Microstrip lines.

UNIT-III

[12 hours]

Waveguides

General solutions for TEM, TE and TM waves, Rectangular waveguide, Circular waveguide, group velocity, phase velocity & wave impedance, corrugated waveguide, Substrate integrated waveguide.

Microwave Passive Components

Scattering Matrix, Reciprocal & lossless networks, Waveguide Tees (E-Plane and H-Plane), Directional Coupler, Magic Tee, Waveguide bends and corners, S-matrix for E-plane Tee junction, S-matrix for H-plane Tee junction, S-matrix for directional coupler, circulator, Isolator.

UNIT-II

[10 hours]

Microwave tubes & Diodes

Limitation of conventional tubes, Two cavity klystron amplifier, Reflex Klystron oscillator, velocity modulation in reflex klystron, Applegate diagram with gap voltage for a reflex klystron, Operation of magnetron, advantages of slow wave devices, principle of operation of TWT, IMPATT , TRAPATT, BARITT, PIN & Varactor diodes.

UNIT-IV

Advancement in Microwave Engineering **[10 hours]**

Introduction to radar technology: CW and FM CW Radar, Doppler & MTI radar,
Introduction to navigation systems: GPS, NavIC, IRNSS systems

Course Outcomes

1. Calculate the VSWR & reflection co-efficient for given load conditions. [BT 3]
2. Analyse the EM wave propagation inside waveguides and transmission lines. [BT 4]
3. Construct the S-parameters of latest microwave devices. [BT 6]
4. Summarize the operational principle and performance characteristics of microwave tubes, diodes & amplifiers. [BT 2]
5. Evaluate the operation of different microwave passive components. [BT 5]
6. Describe the latest technologies in Radar & navigation systems. [BT 1]

Text Books

1. Microwave Engineering, 3rd Edition, David M Pozar, Wiley Publication

Reference Books

1. Microwave Devices and Circuits, S. Y. Liao, PHI Publication
2. Microwave & Radar Engineering, M. Kulkarni, Umesh Publications
3. Fields & Waves in Communication Electronics, Ramo S. Whinnery , 3rd Edition, Wiley

Web Resources

1. http://webee.technion.ac.il/people/schachter/Teaching/Microwaves%202011-2012-locked.pdf
2. http://nptel.ac.in/courses/112105165/
3. http://www.radio-electronics.com
4. http://nptel.ac.in/courses/117105130/
5. http://nptel.ac.in/courses/115101005/

LIST OF EXPERIMENTS

Experiment. No.	Title	Learning Outcomes
1	To study the technical description and function of different microwave components.	To impart basic knowledge of components that is used in microwave engineering.
2	To determine the electronic tuning range of Reflex Klystron tube.	To observe the change in frequency due to change in reflector voltage.
3	To determine the frequency & wavelength in a rectangular waveguide working in TE_{10} mode	To measure the guide wavelength & cut off frequency of TE10 mode propagating in the waveguide.
4	To determine the Standing Wave-Ratio and Reflection Coefficient for different types of load.	To measure the VSWR for transmission line which is terminated in open circuit, short circuit, matched load and any other complex load.
5	Design and Simulate the rectangular waveguide at 3 GHz using HFSS software.	To determine rectangular waveguide dimension and observe TE and TM mode propagation.
6	Design and Simulate the tee junctions at 2 GHz using HFSS software.	To learn the operation of tee junctions as power divider and power combiner.
7	To measure coupling factor and directivity of directional coupler.	To learn the operation of directional coupler.
8	To study the fixed and variable attenuators.	To understand the functions of attenuators.
9	To study the operation of isolator & circulator using microwave test bench.	To understand the functions of isolator & circulator.
10	Study of voice communication by using microwave test bench.	To understand the usage of microwaves for voice communication.

Subject:Optical Communication								
Program: B. Tech. EC Engg				**Subject Code: EC0620**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Outcomes:

The objective of the course is to provide a fundamental understanding of optical communication systems, On Successful completion of this course the student will be able to

1. Analyze the performance of both digital and analogue optical fiber systems and the most advanced topics in this area as well
2. Understand the basic operating principles of light sources, detectors and amplifiers.
3. Be familiar with commonly used components and subsystems in optical communication and network systems
4. To design a simple optical communication link and Solve the main issues in designing an optical communication system.

UNIT-I [12]

Introduction to Optical Fiber Communication:

Historical Development, Optical spectral bands, Advantage of Optical Fiber Communication, Fundamental Data Communication Concepts, Key Elements of Optical Fiber Communication

Optical Fiber Waveguide and Structures:

Ray Theory Transmission, Basic Optical laws and Definitions, Optical Fiber Modes, Single Mode Fibers, Step Index Fibers, Graded Index Fibers

Transmission Characteristics of Optical Fibers:

Attenuation, Material absorption losses in silica glass fibers, Linear scattering losses, Nonlinear scattering losses, Fiber bend loss, Dispersion

UNIT-II [10]

Optical Sources:

Basic concepts, Semiconductor Physics, LED: Operation principal, LED structure, LED power and efficiency, Modulation, LASER: Operation principal, Semiconductor injection laser, Laser Structure and modes, Threshold Gain, Figure of merit, Modulation

Power Launching and coupling:

Source to fiber power launching, Lensing schemes for coupling improvement, Fiber to fiber joints, LED coupling to single mode fibers, Fiber splicing, Optical connectors

UNIT-III **[10]**

Optical Detectors:

Operation principal of Photodiode, types, characteristics, figure of merits , photodiode materials, photodetector noise, detector response time, temperature effects on gain, comparison of photodetectors

Optical Receiver:

Receiver Operation, Noise, Receiver structures, Digital receiver performance, Coherent detection, Link power budget, Rise time budget, Bit error rate

UNIT-IV **[11]**

Optical Amplifiers:

Basic operation and application, Types of optical amplifiers, Semiconductor optical amplifiers, Erbium –Dopped amplifier, Raman amplifier, Amplifier noise, Optical SNR

WDM and Optical Networks:

WDM principal, Optical couplers, Isolators & Circulators, Fiber Grating Filters, Add/Drop Multiplexer, SONET/SDH, Optical Switching

Free Space Optical Communication:

Introduction, Propagation Concepts, Challenges, Advantage, Disadvantages, Applications

Text Books:

Optical Fiber Communications by Gerd Keiser, 5th Edition (Mc Graw Hill)

Reference Books:

1. Optical Fiber Communication by John M. Senior (PHI/Pearson)
2. Fiber optical communication Technology by Djafar Mymbaev & Lowell L, Scheiner. (Pearson)

Subject:Digital Image Processing								
Program: B. Tech. EC Engg				**Subject Code: EC0621**			**Semester: VI**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

UNIT-I

[5 hours]

Introduction

Introduction to Digital Image Processing & Applications, Sampling, Quantization, Basic Relationship Between Pixels. Imaging Geometry. Image interpolation.

UNIT-II

[8 hours]

Image enhancement and filtering in spatial domain:

Intensity transformation functions: Contrast stretching, Thresholding, Image negative, Log transformation, Power - low transformation, Intensity level slicing and Bit - plane slicing.

Image histogram, Histogram equalization process. Fundamentals of spatial filtering, Correlation and convolution, Spatial filtering mask for low pass filtering (smoothing) and high pass filtering (sharpening).

UNIT-III

[16 hours]

Image filtering in the frequency domain:

Preliminary Concepts, Extension to functions of two variables, Image Smoothing, Image Sharpening, Homomorphic filtering, 2D- DFT, 2D-FFT, 2D-DCT,Fundamentals of 2D-wavelet transform, Image pyramids, sub-band coding**.**

Image restoration:

Reasons for image degradation, Model of image degradation/restoration process, Noise probability density functions, Image restoration using spatial filtering (Mean filters, Order statistic filters and adaptive filters), Inverse Filtering, MMSE (Wiener) Filtering.

Colour Image Processing:

Colour Fundamentals, Colour Models, Pseudo – colour image processing.

UNIT-IV

[16 hours]

Image Compression:

Fundamentals of redundancies, Basic Compression Methods: Huffman coding, Arithmetic coding, LZW coding, JPEG Compression standard, Wavelet based image compression.

Image Segmentation:

Edge based segmentation, Region based segmentation, Region split and merge techniques, Region growing by pixel aggregation, optimal thresholding.

Morphological Image Processing:

Basic morphological operations, Erosion, dilation, opening, closing, Structuring elements, Hit Or - Miss transform, Basic Morphological Algorithms: hole filling, connected components, thinning, skeletons , Reconstruction by erosion and dilation

COURSE OUTCOMES :

1. Apply knowledge of mathematics for image understanding and analysis
2. Enhance image quality using image enhancement techniques
3. Filter given image using frequency domain filtering technique.
4. Select the right image restoration technique to remove degradation from given image & Understand the various kind of noise present in the image and how to restore the noisy image

TEXT BOOKS :

1. Digital Image Processing by Rafael C Gonzalez & Richard E Woods, 3rd Edition
2. Digital Image Processing by William K Pratt

REFERENCE BOOKS:

1. Digital Image Processing, S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill Publication.
2. Digital Image Processing, S Sridhar, Oxford University Press.

WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc16_ec14
2. **https://nptel.ac.in/syllabus/117105079/**

Experiment List

1. To write and execute image processing programs using point processing methods Obtain Negative image, Obtain Flip image, Thresholding, Contrast stretching .
2. To write and execute programs for image arithmetic & logical operations operations Addition of two images, Subtract one image from another image, Calculate mean value of Image, Different Brightness by changing mean value, AND operation between two images, OR operation between two images. Calculate intersection of two images Watermarking using EX-OR operation, NOT operation (Negative image)
3. To write a program for histogram calculation and equalization.
4. To write a program for Bit plane slicing & Spatial resolution.
5. To understand various image noise models and to write programs for image restoration
   Remove Salt and Pepper Noise
   Minimize Gaussian noise
   Median filter and Weiner filter
6. Write and execute programs to remove noise using spatial filters
7. To write a program for JPEG compression
8. Write and execute programs for image frequency domain filtering
   Apply FFT on given image
   Perform low pass and high pass filtering in frequency domain
   Apply IFFT to reconstruct image
9. Write a program for edge detection using different edge detection mask
10. Write and execute a program for image morphological operations erosion and dilation.
11. To write and execute a program for wavelet transform on given image and perform inverse wavelet transform to reconstruct image.

SEMESTER-VII

SYLLABUS

Subject: Cryptography and Cyber Security								
Program: B. Tech. EC Engg				**Subject Code: EC0716**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	0	3	40	0	60	0	100

Course Outcomes:

The course provides an overview of cryptography and network security, after completing this course the student will be able to

1. Explain and make practical use of the concepts, principles and mechanisms for providing security to the information/data.
2. Select the optimum security protocol according to application requirements.
3. Design security model of application level and network level security.
4. Design encryption algorithms.

UNIT-I **[10]**

Introduction: OSI Security Architecture, Classical Encryption techniques, Cipher Principles, Cryptography, Cryptanalysis and Attacks; Substitution and Transposition techniques

Symmetric Key Cryptography:

Stream ciphers and block ciphers, Block Cipher structure, Feistel Cipher, Diffusion and Confusion, Data Encryption standard (DES) with example, strength of DES, Design principles of block cipher, AES, Multiple encryption and triple DES, Electronic Code Book, Cipher Block Chaining Mode, Cipher Feedback mode, Output Feedback mode, Counter mode, RC4 algorithm, Confidentiality using Symmetric encryption, Key Distribution, Random Number Generator

UNIT-II **[13]**

Public Key Cryptography:

Key Management, Diffie-Hellman key Exchange, Elliptic Curve Architecture and Cryptography, Introduction to Number Theory, Confidentiality using Symmetric Encryption, Public Key Cryptography and RSA.

Message Authentication and Hash Functions:

Authentication Requirements, Authentication Functions, MAC, Hash Functions, Security of Hash Functions and MACs, Secure Hash Algorithm, MD5

UNIT-III **[13]**

Digital Signatures and Authentication Applications :

Authentication Protocols, Kerberos, DSS, X.509 Authentication Service, Digital Signatures

Network Security:

PGP, S/MIME, IPSec Architecture, Authentication Header, ESP, Combining Security Association, Key Management, Web Security Consideration, SSL and TLS, Introduction to E-Commerce, Secure Electronic Transaction (SET).

UNIT-IV **[12]**

System Level Security:

Intrusion detection, Password management, Viruses and related Threats, Virus Counter measures, Firewall Design Principles, Trusted Systems, DDOS attack, Smart Cards and Security, Zero Knowledge Protocol, Database Access Control

Text Books:

William Stallings, “Cryptography and Network Security – Principles and Practices”, Pearson Education

Reference Books:

1. Bruce Schneier, “Applied Cryptography”, John Wiley & Sons Inc
2. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, Third Edition, Pearson Education
3. Atul Kahate, “Cryptography and Network Security”, Tata McGraw-Hill
4. Wenbo Mao, “Modern Cryptography Theory and Practice”, Pearson Education

Subject:Wireless Communication								
Program: B. Tech. EC Engg				**Subject Code: EC0717**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Objectives:

1. To Understand the era of wireless communication system
2. Get the knowledge of all important concept of wireless systems
3. Implement the propagation model for different environments
4. Understand the working of today's GSM and CDMA architecture
5. Know the recent trends in wireless communication systems

UNIT-I **[12]**

Elements of Cellular Radio System Design

Introduction of cellular system, General description of problem, Concept of frequency reuse channels, Interferences, Handoff mechanism, Umbrella concept, Trunking and Grade of Service, Techniques to improve coverage and capacity in cellular system.

UNIT-II **[10]**

Frequency Management and Channel Assignment

Frequency management, Frequency-spectrum utilization, Set-up channels, Definition of channel assignment, Fixed channel assignment, Nonfixed channel assignment algorithms, Traffic and channel assignment, Value of implementing handoffs, Initiation of a handoff, delaying a handoff, Forced handoffs, power-difference handoffs, Mobile assisted handoff and soft handoff, Introduction to dropped call rate, Formula of dropped call rate

UNIT-III **[10]**

Multiple access techniques and Propagation models of Mobile Radio

FDMA, TDMA, CDMA, OFDM, Radio wave propagation, Transmit and receive signal models, Free-Space path loss, Ray tracing, Empirical path-loss models, Shadow fading,

Combined pathloss and shadowing, Outage probability under path loss and shadowing, cell coverage area.

UNIT-IV **[11]**

Digital Cellular Systems

GSM architecture, GSM channel types, GSM speech coding, Location tracking and call setup, security, Data services, Supplementary service data, GSM location update, Mobility databases, Failure restoration, CDMA architecture, RAKE receiver, Frequency and channel specifications, PDC,PHS,WCDMA,GPRS system architecture, Introduction to Wi-Fi, WiMAX, ZigBee Networks, Software defined radio, UWB radio, Wireless Adhoc network and mobile portability, Security issues and challenges in a wireless network.

Text Books:

1. Mobile Cellular Telecommunications analog and digital systems, William C. Y. Lee. 2nd Edition, MGH.

2. Wireless Communication", Theodore S. Rappaport, Prentice hall.

Reference Books:

1. Wireless and Mobile Network Architecture by YI-Bang Lin and Imrich Chlamtac, Wiley publication.

2. "Wireless Communications and Networking ",Vijay Garg, Elsevier

3. Mobile and personal Communication system and services by Rajpandya, IEEE press(PHI).

Subject:Biomedical Instrumentation and Imaging								
Program: B. Tech. EC Engg				**Subject Code: EC0718**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Objectives

The objective of this course is

1. To introduce student to basic biomedical engineering & Imaging technology and introduce different biological signals, their acquisition, measurements and related constraints.
2. To understand basic principles and phenomena in the area of medical diagnostic & imaging instrumentation
3. Theoretical and practical preparation for enabling students to maintain medical instrumentation.

CONTENTS

UNIT-I

[12 hours]

Fundamental of Biomedical Instrumentation and Origin of Biopotential:

Sources of Biomedical signals, general constraints in designing of medical instrumentation systems, Generalized medical instrumentation block diagram, origin of bioelectric signals: ECG, EEG, EMG , Classification of Medical instruments.

Transducers & Electrodes: The Transducers & Transduction principles, Active transducers, Passive Transducers, Transducer for Biomedical Applications. Electrode theory, electrode behavior and circuit model of Electrode ,Types of Electrode , Electrode for Biomedical Applications

UNIT-II

[12hours]

Biomedical Recorders

Electrocardiograph(ECG) machine ,ECG block diagram ,Bipolar and unipolar leads ,Phono-cardiograph ,Electroencephalograph (EEG),10-20 electrode placement system ,EEG readout device ,Electro-myograph (EMG) machine, Bio-feedback Instrumentation

Patient Monitoring System:
Measurement of heart rate, blood pressure measurement, blood flow meter, blood gas analyzer, electromagnetic blood flow meter, ultrasonic blood flow meter, NMR blood flow meter, blood gas analyzer.

UNIT-III

[12 hours]

Medical Imaging Equipments:
X-ray machine, CT-Scan machine,MRI machine , Properties of ultrasound ,Ultrasonic foetal monitors, Echoencephalography, Echo-cardiograph., Colour Doppler ultrasound machine.

UNIT-IV

[12hours]

Recent Trends in Medical Instrumentation:

Thermograph, endoscopy unit, Laser in medicine, Diathermy units, Cardiac Pacemaker

Patient Safety :
Physiological effects of electricity, important susceptibility parameters, macro shock hazards, micro shock hazards, basic approaches to protection against shock.

Course Outcome:
After successful completion of the course, student will be able to

1. understand medical terminology & origin of Bio potentials relevant to biomedical instrumentation
2. Understand measurement ,display and analysis of various bio signals.
3. understand different medical imaging systems for different diagnoses
4. Know about Endoscopy unit, Laser in medicine and Electrical safety in medical Equipment

Text Books

1. R.S. Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill Publication.
2. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, "Biomedical Instrumentation and Measurement", Prentice Hall India Pvt. Ltd. , New Delhi, 2nd Edition, Reprint, 2013.

Reference Books

1. L.A Geddes and L.E.Baker , "Principles of Applied Biomedical Instrumentation" Third Edition,John Wiley and sons, Reprint 2008.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 3rd Edition, 2014.
3. Carr & Brown, Introduction to biomedical equipment technology, Prentice Hall Publication.

Web Resources

1. https://nptel.ac.in/courses/108105101/
2. https://nptel.ac.in/courses/117108037/15
3. http://www.vlab.co.in/ba-nptel-labs-biotechnology-and-biomedical-engineering
4. https://lecturenotes.in/subject/27/biomedical-instrumentation-bi

Subject:Embedded System								
Program: B. Tech. EC Engg				**Subject Code: EC0719**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Objectives:

· Understand ARM7 architecture and real time operating system

· Interface various peripherals with microcontroller through programming

UNIT-I **[10]**

Introduction

Embedded system and general purpose computers, Embedded system components, Embedded System Design Process Classification of an embedded system, Examples of an embedded system Applications of an embedded system.

ARM Architecture

ARM Programming Model, Processor Modes, Registers, Exceptions, Interrupts & the vector table, Pipeline, 3-stage Pipeline ARM Organization, 5-stage Pipeline ARM Organization

UNIT-II **[13]**

ARM Instruction set

Data Processing Instructions, Branch Instructions, Load-Store Instructions, Software-Interrupt Instruction, Program status register instruction, Multiply instruction, Assembly language Program

Thumb Instruction set

Thumb programmers model, Thumb branch instruction, Thumb software interrupt instruction, Thumb data process instruction, Thumb single register data transfer instruction, Thumb multiple register data transfer instruction, Thumb breakpoint instruction

UNIT-III **[13]**

Interprocess communication and synchronization

Multiple process & thread in application, Task and task state, Task control block ,Task coding, Task scheduling, Semaphores for synchronization, Data sharing & deadlocks, Interprocess Communication

UNIT-IV **[12]**

RTOS

Operating system services, Process management, Timer & Event function, Memory management, Device, file, I/O subsystem management, Interrupt routine in RTOS environment and handling of interrupt service calls, Basic design using RTOS, RTOS task scheduling models, Interrupt latency and response of task & performance metrics, OS security issues

Course Outcomes:

1. Define and explain embedded systems and the different embedded system design technologies explain the various metrics or challenges in designing an embedded system. [BT 1,2]
2. Discuss about optimizing single – purpose processors. Discuss about the basic architecture and operation of general-purpose processors. [BT 2]
3. Explain about the basics of interrupts. Explain the different architectures like Round Robin. Describe the Real – Time Operating System architecture. [BT 2]
4 Analyze the embedded systems' specification and develop software programs. [BT 4]
5 Evaluate the requirements of programming Embedded Systems, related software architectures and tool chain for Embedded Systems. [BT 5]
6 Design real time embedded systems using the concepts of RTOS. [BT 6]

Text Books:

1. Raj Kamal, "Embedded System Architecture, Programming and Design", Tata McGraw-Hill

2. Steve Furber, "ARM System on Chip Architecture", Pearson Education

Reference Books:

1. Wayne Wolf, “Computer as Components: Principles of Embedded Computing System Design”, Morgan Kaufmann Publication

2. Andrew N. Sloss, Dominic Symes , Chris Wright, “ARM System Developer’s Guide Designing and Optimizing System Software”, Morgan Kaufmann Publishers

ज्ञानेन प्रकाशते जगत् INDUS UNIVERSITY	INDUS INSTITUTE OF TECHNOLOGY & ENGINEERING Constituent Institute of Indus University

Subject: Machine Learning								
Program: B Tech EC				Subject Code: EC0733			Semester: VII	
Teaching Scheme (Hours per week)				Examination Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credits	University Theory Examination	University Practical Examination	Continuous Internal Evaluation (CIE)- Theory	Continuous Internal Evaluation (CIE)- Practical	Total
3	0	2	4	40	40	60	60	200

Course Objectives:

1. Apply regression techniques for machine learning examples.
2. Comprehend supervised and unsupervised machine learning techniques.
3. Apply the neural network and dimensionality reduction techniques for machine learning applications.
4. Design and implement machine learning algorithms to solve real-world application problems.
5. Understand and learn state of the art machine learning techniques to provide employability in industry.

CONTENTS

UNIT-I

[7 hours]

Introduction
Motivation and Applications, Basics of Supervised and Unsupervised Learning.
Regression Techniques Basic concepts and applications of Regression, Simple Linear & Multiple Regression, Gradient Descent, Hyper-parameters tuning, Evaluation Measures for Regression Techniques.

UNIT-II

[9 hours]

Classification Techniques
Naïve Bayes Classification, K-Nearest Neighbors, Classification Trees, Support Vector Machines, Evaluation Measures for Classification Techniques.

UNIT-III

[12 hours]

Neural Networks Biological Neurons and Biological Neural Networks, Perceptron Learning, Activation Functions, Multilayer Perceptron, Back-propagation Neural Networks, Convolution Neural Network. **Dimensionality Reduction & Clustering** PCA, k-means Clustering.

UNIT-IV

Reinforcement Learning Basics concepts of reinforcement learning and applications.
Applications and Case Studies Case studies on deep learning and RNN

Advanced topics
Semi-supervised, Active Learning, Reinforcement Learning, Recent trends in various learning techniques of machine learning and classification methods, Overview of typical application areas, such as Recommender System

Course Outcomes:

At the end of this subject, students should be able to:

1. Get exposure of machine learning concepts and range of problems that can be handled by machine learning
2. Compare and parameterize different learning algorithms
3. Apply the machine learning concepts in real life problems
4. Understand learning in machines with different techniques
5. Understand and apply various recognition techniques.
6. Learn about parameter selection and feature extraction.

Text Books:

1. Tom M Mitchell, "Machine Learning", McGraw Hill.
2. Peter Harrington, "Machine Learning in Action", DreamTech.

Reference Books:

1. Henrik Brink, Joseph Richards, Mark Fetherolf, "Real-World Machine Learning", DreamTech
2. Christopher Bishop, "Pattern Recognition and Machine Learning, "Hastie, Tibshirani, and Friedman, "Elements of Statistical Learning". Springer
3. Jiawei Han and Michelline Kamber, "Data Mining: Tools and Techniques", 3rd Edition.
4. I H Witten, Eibe Frank, Mark A Hall, "Data Mining: A practical Machine LearningTools and techniques", Elsevier

Web Resources:

1. Couresera.org: Machine Learning by Andrew Ng, Stanford University

LIST OF EXPERIMENTS

Experiment. No.	Title	Learning Outcomes
1.1	Study of various Machine Learning tools(Scikit, Weka, Matlab)	Get exposure of machine learning language
1.2	Write a program to implement Linear Regression	Understand the actual working of regression for prediction
1.3	Write a program to implement KNearest Neighbors	Understand the actual working of regression for prediction
1.4	Write a program to implement Random Forest Algorithm	Understand the actual working of classification for label prediction
1.5	Write a program for classification in a data set.	Understand the actual working of classification for label prediction
1.6	Write a program for Automatic grouping of similar objects into sets	Understand the unsupervised technique
1.7	Write a program to implement Genetic Algorithm	Learn various GA operators in solving different types of GA problems
1.8	Write a program to implement OR, AND gate using Perceptron with learning rule.	Understand the mathematical equation of various parameters
1.9	Write a program to Implement Back-propagation algorithm.	Understand the mathematical equation and role of various parameters
2.0	Case Study – any deep learning application	Understand the mathematical equation and role of various parameters

Subject: **Antenna & Wave Propagation**								
Program: **B.Tech. EC Engineering**				Subject Code: EC0721			Semester: 7TH	
Teaching Scheme (Hours per week)				**Examination Evaluation Scheme (Marks)**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/40	16/40	16/40	200

Course Objectives

1. The objective of this subject is to deliver an in-depth knowledge of the basic antennas and their applications.
2. To give the practical design consideration and simulation of various antennas for different applications.
3. To deliver practical insight of the arrays of the antennas for specific applications.
4. To cover the basic theoretical concepts for the radio wave propagation.
5. To explore the design and analysis of the modern trend antennas based on metamaterials and electronic bandgap structures.

CONTENTS

UNIT-I

[12 hours]

Overview of antennas

Definitions, Types of Antennas & applications, Current distribution on a thin wire antenna, Radiation mechanism, Antenna parameters, radiation pattern, antenna field zones, radiation power density, radiation intensity, directivity, gain, antenna efficiency, half-power beamwidth, first null beamwidth, beam efficiency, bandwidth, polarization, input impedance, antenna radiation efficiency, antenna effective area , Friss transmission equation.

Radiation integral

Vector potential A and F for Electric & Magnetic current sources J & M, E and H field for electric and magnetic current sources, Far field radiation, reciprocity theorem, radiation form current element and dipole, radiation patterns of different dipoles, radiation power density, radiation resistance & directivity of dipole.

UNIT-II

[11 hours]

Antenna Arrays

Two-element array, N-element linear array- Uniform amplitude & spacing, array/space factor, broadside array, end-fire array, N-element linear array- Uniform spacing & non uniform amplitude, planar array, introduction to active phased (scanning) array and adaptive arrays.

Wave Propagation
Ground wave propagation, terrain and earth curvature effects, tropospheric propagation, fading, diffraction and scattering, ionospheric propagation, refractive index, critical frequencies, maximum usable frequency, effects of magnetic field.

UNIT-III

[11 hours]

Horn antennas: Field equivalence principle: Huygens principle, Babinet's principle, E-plane sectoral horn, H-plane sectoral horn, aperture fields, radiated fields, directivity, pyramidal horn, conical horn, corrugated horn, phase centre calculation in horn antennas.

Reflector antennas:
Plane reflector, corner reflector, parabolic reflector, front fed parabolic reflector, dual symmetrical and offset reflectors (Cassegrain & Gregorian antenna).

UNIT-IV

Advancement of Antennas:
Reconfigurable Microstrip patch antennas, helical antenna, Fractal antenna, Electronic bandgap antenna, metamaterial antennas, stacked and surface wave antennas.

Course Outcomes

1. To understand the different types of antennas and the radiation mechanism.
2. To evaluate the fundamental parameters of antennas and arrays of antennas.
3. To understand the mechanism of radio wave propagation.
4. To determine the Array factor for various types of arrays of antennas.
5. To acquire the ability to design various types of linear and planar antennas.
6. To design and analyze the modern trend antennas based on metamaterials and electronic bandgap structures.

Text Books

1. Antenna Theory: Analysis and Design, 3rd Edition, C A Balanis, Wiley Publication.
2. Antennas, J D Krauss, McGraw-Hill Higher Education.

Reference Books

1. Electromagnetic Wave and Radiating Systems, Edward C. & Balmain, Keith G. Jordan. Prentice Hall of India.
2. Electronic and Radio Engineering, F.E. Terman, McGraw-Hill, 4th edition, 1955.

Web Resources

1. http://nptel.ac.in/courses/117107035/
2. https://www.tutorialspoint.com/antenna_theory/
3. http://www.radio-electronics.com/info/antennas/

4. http://nptel.ac.in/courses/108101092/

LIST OF EXPERIMENTS

Experiment. No.	Title	Learning Outcomes
1	To study the variation of field strength with respect to distance from transmitting antenna.	To understand the relationship between the field strength and distance from the transmitting antenna.
2	Demonstrate that the transmitting and receiving radiation pattern of an antenna are equal; therefore confirm the reciprocity theorem of antennas.	To understand the reciprocity theorem for Antennas and their radiation patterns.
3	To plot the radiation pattern of an Omni directional antenna.	To acquire the basic understanding of Omnidirectional antennas and to plot its radiation pattern on polar graph.
4	To plot radiation pattern of directional antenna.	To acquire the basic understanding of Omnidirectional antennas and to plot its radiation pattern on polar graph.
5	To study and plot the radiation pattern of the helical antennas and measure Gain and Beam width.	To calculate the gain and beamwidth of helical antenna from its measured radiation pattern.
6	To study and plot the radiation pattern of the Broadside array and measure Gain and Beam width.	To calculate the gain and beamwidth of broadside array antenna from its measured radiation pattern.
7	Design and simulate dipole antenna in HFSS.	To determine the design parameters of dipole antenna and to observe its far field radiation pattern.
8	Design and simulate conical horn antenna in HFSS.	To determine the design parameters of conical horn antenna and to observe its far field radiation pattern.
9	Design and simulate Microstrip antenna in HFSS.	To determine the design parameters of Microstrip patch antenna and to observe its far field radiation pattern.
10	Mini Project	To design the antenna for suitable wireless applications.

Subject:Error Correcting Codes								
Program: B. Tech. EC Engg				**Subject Code: EC0722**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

UNIT-I **[10]**

Introduction to coding theory, Coding for reliable digital Transmission, Types of codes, Types of errors, Average mutual information and Entropy, introduction to source coding & Channel coding theorem, Huffman coding.

UNIT-II **[13]**

Linear block codes: Basics, matrix description of linear block codes, Equivalent codes, parity check matrix, decoding of linear block codes, syndrome decoding, probability of error correction, Perfect codes, Hamming codes.

UNIT-III **[13]**

Cyclic codes: Polynomials, The division algorithm for polynomials, A method of generating cyclic codes, matrix description of cyclic codes, Cyclic encoding, Syndrome decoding, Introduction to BCH codes, Golay codes.

UNIT-IV **[12]**

Convolution codes, tree and trellis codes, analytical representation of convolution codes. Trellis coded modulation basics, turbo coding and decoding

Course Outcomes:

The students will acquire technical/mathematical skills in error control coding. After the course, the students will be able to:

- Explain the relations between minimum distance, error correcting and error detecting capability, block and bit error rate and coding gain, and calculate or estimate these quantities for simple block codes

- Implement a transmitter and syndrome-based decoder for an arbitrary block code, and evaluate their performance by simulations
- Define and analyze the properties of product-like codes, LDPC codes, turbo-like codes, and rateless codes
- Explain the principles of iterative decoding, the sum-product algorithm, EXIT chart analysis and density evolution
- Implement transmitters and receivers for turbo and LDPC codes using iterative decoding
- Choose a code family, code parameters, and a decoding method, to fulfill given requirements on error correcting capability and complexity

Text Books:

1. Lin shu,Shu lin and Daniel Costello, ‘Error control coding’ Prentice Hall, 2nd Ed, 2004

Reference Books:

2. Todd k.Moon, ‘Error correcting coding: mathematical Methods & algorithms’, Wiley India

Subject:Satellite Communication								
Program: B. Tech. EC Engg				**Subject Code: EC0723**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Objectives

- To understand the performance parameters of satellite communication systems
- To provide an in-depth knowledge of satellite communication systems operation and planning
- To understand the basic technical knowledge of orbital dynamics and subsystems used in space segment and ground segment.
- To prepare test plans to verify the specifications
- To design test procedures for verification of system/sub-system specifications
- To analyze the various methods of satellite access
- To understand various application of satellite communication

.

CONTENTS

UNIT-I

[12 hours]

Introduction to Satellite Communication

Benefits of satellite communication, Historical evolution of communication satellites, Satellite communication in India, Elements of satellite communication, Types of satellites, Satellite services, Satellite network configurations, Satellite frequency bands

Satellite Orbits and Orbital Parameters

Introduction, Types of orbits, Kepler's laws, Orbital Elements, Solar Time and Sidereal Time, Satellite Orbits, Orbital Perturbations, Satellite position determination, Limits of visibility, earth eclipse of satellite, Eclipse of satellite, Satellite Launching, Geolaunching Methods

UNIT-II

[12 hours]

Space Segment

Introduction to Satellite System, Transponder Subsystem, Antenna Subsystem, Altitude and Orbit Control (AOC) Subsystem, Telemetry, Tracking and Command Subsystem, Power Subsystem, Thermal Subsystem, Structural Subsystem, Reliability and Quality Assurance

Ground Segment
Introduction, Elements of an Earth Station, Types of earth stations, Earth Station transmitter, Earth Station Receiver, Antenna and Feed Systems, Antenna Tracking, High Power Amplifier, Low Noise Amplifier, Up-converter, Down converter, IF subsystems, Baseband subsystems, Terrestrial Interface equipment, Earth station performance, Redundancy and reliability, Mission Control for Communication Satellites

UNIT-III

[10 hours]

Propagation effects
Rain attenuation, Depolarization, Cross polarization, Propagation impairments and Mitigation techniques

Satellite link design
Introduction, Satellite Communication system model, Basic transmission equation, Noise at the receiver, G/T ratio for earth stations, Uplink Equations, Downlink Equations, Total link, System Design Examples

UNIT-IV

[12 hours]

Satellite Multiple Access
Introduction, Frequency Division Multiple Access, SCPC, MCPC, SPADE,
Time Division Multiple Access, SS-TDMA, Acquisition and Burst synchronization, Spread Spectrum Multiple Access Demand Assigned Multiple Access, Random Access

Satellite Applications
VSAT Systems, Voice Network Configurations, Data Networks, VSAT Terminal Broadcast Services: TVRO, DTH, DVB, HDTV Satellite Radio, DAB Satellite News Gathering Satellite broadcast standards

Course Outcomes

- Understand the performance parameters of satellite communication systems
- Provide an in-depth knowledge of satellite communication systems operation and planning
- Understand the basic technical knowledge of orbital dynamics and subsystems used in space segment and ground segment.
- Prepare test plans to verify the specifications
- Design test procedures for verification of system/sub-system specifications
- Analyze the various methods of satellite access
- Understand various application of satellite communication

Text Books

- Dennis Roddy, “Satellite Communication”, 4th Ed., McGraw Hill, 2008
- T.Pratt, C.Bostian, J.Allnutt, “Satellite Communications” 2nd Ed., Wiley India, 2009

Reference Books

1. Louis J. Ippolito, Jr., “Satellite Communications Systems Engineering”, Wiley, 2008
2. B.G.Evans, “Satellite Communication Systems”, IET Telecommunication Series 38, 2008
3. M.Richharia, “Stellite Communication Systems: Design Principles”, McGraw Hill, 1999

Subject:IOT and Applications								
Program: B. Tech. EC Engg				**Subject Code: EC0724**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Objectives

- Student will understand the concepts of Internet of Things
- Able to understand the application areas of IoT
- Understands the Protocols for IoT

CONTENTS

UNIT-I

[10 hours]

Introduction to IoT

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs

IoT & M2M

Machine to Machine, Difference between IoT and M2M, Software define Network

UNIT-II

[10 hours]

Network & Communication aspects

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

Challenges in IoT

Design challenges, Development challenges, Security challenges, Other challenges

UNIT-III

[10 hours]

Introduction to Python Programming

Python IDE, Data-types in Python, Controlling Statements, Functions in Python, Functions as Objects, Variable Scope in Python, Modules in Python, File Operations, Networking in Python

Introduction to Raspberry pi

Introduction to Raspberry pi, Basic Architecture, Raspberry Pi GPIO, Operating System, Programming through raspberry pi, Implementation of IoT with raspberry pi

UNIT-IV

[10 hours]

Developing IoTs

Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

Domain Specific applications of IoT

Home automation, Industry applications, Surveillance applications, Other IoT applications

Course Outcomes:

After the completion of the course , the student will,

- Understands the concepts of Internet of Things
- Analyze basic protocols in Wireless Sensor Networks
- Design IoT applications in different domain and be able to analyze their performance
- Implement basic IoT applications on embedded platform

Text Books:

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”
2. The Internet of Things Enabling Technologies, Platforms, and Use Cases , Pethuru Raj Anupama C. Raman , CRC Press

Reference Books:

1. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

Subject:Analog VLSI design								
Program: B. Tech. EC Engg				**Subject Code: EC0725**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Objectives

The main objective of this course is to provide the basic physical behavior and modeling of MOS transistors and analog integrated circuits. The basic understanding of design of single stage and differential amplifier is provided. Basic understanding of analyzing the analog integrated circuit considering noise and frequency is explained.

CONTENTS

UNIT-I

Basic MOS Device Physics **[10 hours]**

MOSFET I-V Characteristics, Second order effects, MOS capacitor model, MOS small signal model.

Single Stage Amplifiers:
Basic Concepts, Common source stage, Source Follower, Common Gate stage, Folded Cascode, Choice of device model

UNIT-II

Differential Amplifier: **[12 hours]**
Single-Ended Operation, differential operation, Basic Differential Pair: Qualitative Analysis, Quantitative Analysis, Common Mode Response, Differential Pair with MOS loads, Small signal analysis and voltage gain of the amplifier, Gilbert Cell

UNIT-III

Passive and Active Current Mirrors: **[12 hours]**

Need for Current mirrors, Current source applications in analog circuit, Basic Current Mirrors: DC analysis, Cascode Current mirrors, Biasing of Current Mirrors, Active current Mirrors.

UNIT-IV

Frequency Response of Amplifiers: **[12hours]**
General consideration, Common-Source Stage, Source Followers, CG stage, Cascode stage, Differential Pair.

Noise:
Statistical Characteristics of the noise, Types of the Noise, Representation of noise in the circuits, Noise in Single stage Amplifier, Noise in Differential Pairs, Noise bandwidth

Course Outcomes

- Students can understand basic physics and operation of MOS device.
- Student will be able to design single-stage and differential amplifier and current mirrors.
- Student will able to analyse the circuit considering noise and frequency as parameters.

Text Books

1. Design of Analog CMOS Integrated Circuits *by Behzad Razavi, Tata MaGraw Hill Edition*

Reference Books

1. Analog Integrated Circuit Design *by David A Johns, Ken Martin, Wiley Edition.*

Web Resources

https://onlinecourses.nptel.ac.in/noc19_ee25/preview

Subject:Robotics and Computer Vision								
Program: B. Tech. EC Engg				**Subject Code: EC0730**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Objectives:

1. To describe the history and early beginning of robotics.
2. Aims to develop the understanding of Robotics Components.
3. To apply creative approaches to practical applications, identify technological opportunities in robotics.
4. To impart knowledge about the engineering aspects of Robots and their applications

CONTENTS

UNIT-I

[8 hours]

Computer Vision and Digital Image

Introduction. The human eye and the camera. Vision as an information processing task. Homogeneous transformations. A geometrical framework for vision. 2D and 3D image interpretation. Industrial applications. Basics of image processing. Image acquisition. Segmentation, Binary and grey Morphology operations. Thresholding. Filtering. Edge and corner detection. Feature detection. Contours. Tracking edges and corners. Object detection and tracking. Image data compression, Real time Image processing.

UNIT-II

[8 hours]

Camera and Optical System

Light used in machine vision. Basic rules and laws of light distribution. Filters. Light sources. Light techniques. Choice of illumination. Camera technology. Analog and digital camera. Camera model. CCD and CMOS Technology. Sensor size. Intrinsic and extrinsic camera parameters. Camera calibration. Systems of lenses The thin lens. Beam converging and beam diverging lenses. General imaging equation. Aberrations. Practical aspects.

UNIT-III

[16 hours]

Fundamental of Robot. Robotics

Introduction. Robot. Definition. Robot anatomy. Robot parts and their functions. Classification of robot and robotic systems. Laws of robotics. Co-ordinate systems. Drives and control systems, Power transmission systems. Planning for navigation. Different applications.

Kinematics of Robot.

Introduction. Definition. Open and closed kinematic mechanisms. Matrix representation. Homogeneous transformation, forward and inverse kinematics. Direct vs inverse kinematic task. Programming. Basics of Trajectory planning.

UNIT-IV

[16 hours]

Robot Actuator Effectors and Industrial Applications.

Types of end effectors. Types of grippers. Interface. Sensors. Touch and Tactile sensors. Quality control. Mapping and robot guidance. Motion estimation. Passive navigation and structure from motion .Autonomous systems.

Course Outcomes

At the end of this subject, students should be able to:

1. Demonstrate use of engineering methods and problem solving towards design of the specified robot.
2. Compare and contrast various mechanical systems.
3. Describe Robot control & its applications.
4. The students will be able to analyse and design robotic structures.

Text Book	**[1]**	Sonka, Hlavc and Boyle "**Digital Image Processing and Computer Vision**", Cengage Learning,ISBN-978-81—315-0555-7,2008
	[2]	Alexander Hornberg "**Handbook of Machine Vision**",WILEY-VCH,2006
	[3]	R K Mittal and I J Nagrath "**Robotics and Control**", TMH publication,2003
Reference Books	**[R1]**	Richard Szeliski "**Computer Vision: Algorithms and Applications**", Ed. Springer, ISBN-10: 1848829345, ISBN-13:978-1848829343, Publishing, 2010.
	[R2]	J R Parker "**Algorithms for Image Processing and Computer Vision**",ISBN-978-0-470-64385-3,Second Edition, Wiley Publication,2011.
	[R3]	Bruno Siciliano "**Handbook of Robotics**", Ed. Springer-Verlag Berlin and Heidelberg GmbH & Co. K, ISBN-10:354023957X, ISBN-13: 978-3540239574, Publishing, 2008.
	[R4]	Boguslaw Cyganek and J Paul Siebert "**An Introduction To 3D Computer Vision Techniques And Algorithms**", WILEY Publication, ISBN- 978-0-470-01704-3, 2009.

Subject:Mobile Communication and Networks								
Program: B. Tech. EC Engg				**Subject Code: EC0731**			**Semester: VII**	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	40	40	60	60	200

Course Outcomes:

After successfully completing this course the students…

- Will be exposed to the most important problems and solutions involved in current and emerging services and applications relying on mobile and radio technologies.
- Can describe the emerging advanced mobile communications systems from several perspectives: systems and network architectures, protocols, mobility management, applications and services.
- Can explain the similarities and major differences between current and emerging communication systems including mobile, nomadic or, simple wireless connectivity.
- Will have the ability to work in operational department of mobile communication service provider company.

UNIT-I **[10]**

Introduction of mobile communication

Wireless Communications and Diversity- Frequency, Time, Space, Fast Fading Wireless Channel Modeling, Rayleigh/Ricean Fading Channels, BER Performance in Fading Channels, Diversity modeling for Wireless Communications, BER Performance Improvement with diversity

Architectural Review of UMTS and GSM, History of Mobile Telecommunication Systems, the Need for LTE, From UMTS to LTE, From LTE to LTE-Advanced, The 3GPP Specifications for LTE

UNIT-II **[13]**

LTE Architecture and its performance

System Architecture Evolution: High-Level Architecture of LTE, User Equipment, Evolved UMTS Terrestrial Radio Access Network, Evolved Packet Core, Communication Protocols, Example Signalling Flows, State Diagrams

Architecture of the LTE Air Interface: Air Interface Protocol Stack, The Resource Grid, Multiple Antenna Transmission, Resource Element Mapping, Acquisition Procedure, Procedures after Acquisition

UNIT-III **[13]**

MOBILITY management and security in LTE

Mobility Management: Transitions between Mobility Management States, Cell Reselection in RRC_IDLE, Measurements in RRC_CONNECTED, Handover in RRC_CONNECTED, Inter-operation with UMTS and GSM, Inter-operation with Non-3GPP Technologies

Security Procedures: Network Access Security, Network Domain Security

UNIT-IV **[12]**

Enhancement and performance in LTE technology

VoLTE and the IP Multimedia Subsystem: Hardware Architecture of the IMS, Service Provision in the IMS, VoLTE Registration Procedure, Call Setup and Release, Single Radio Voice Call Continuity, Delivery of SMS Messages over the IMS

Performance of LTE: Peak Data Rates of LTE, Coverage of an LTE Cell, Capacity of an LTE Cell, Performance of Voice over IP LTE ADVANCED:Carrier Aggregation, IMT-2000 development, LTE-Advanced – The 3GPP candidate for IMT-Advanced, Technical components of LTE-Advanced

Text Books:

1. Cox, Christopher “An introduction to LTE: LTE, LTE-advanced, SAE,VoLTE and 4G mobile communications” 2nd John Wiley & Sons, 2014.
2. Dahlman, Erik, et al. “3G evolution: HSPA and LTE for mobile broadband ” Academic press, 2010.

3. Goldsmith, Andrea " Wireless communications" Cambridge university press, 2005.

Reference Books:

1. Olsson, Magnus, et al. "SAE and the Evolved Packet Core: Driving the mobile broadband revolution" Academic Press, 2009.
2. Rappaport, Theodore S. " Wireless communications: principles and practice" Vol. 2. New Jersey: Prentice Hall PTR, 1996.
3. Biglieri, Ezio, et al. " MIMO wireless communications" Cambridge university press, 2007.

Digital Learning Resources:

1. http://nptel.ac.in/courses/117104099/
2. https://www.coursera.org/learn/wireless-communication-technologies

Subject: IoT Communication Networks								
Program: **B.Tech. Electronics & Communication Engineering**				Subject Code: EC0732			Semester:7th	
Teaching Scheme (Hours per week)				**Examination Evaluation Scheme (Marks)**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	60	60	40	40	200

Course Objectives

1. To identify and expose the students to the central elements in the design of communication protocols for the WSNs.
2. To disseminate the design knowledge in analyzing the specific requirements for applications in WSNs regarding energy supply, memory, processing, and transmission capacity
3. To get the perception of mobile ad hoc networks, design, implementation issues, and solutions based on different algorithms and protocols for power management, sensor data routing and query processing.
4. To associate, hardware platforms and software frameworks used to realize dynamic Wireless sensor network

CONTENTS

Unit 1

Wireless Sensor Network

Background of Sensor Network Technology, MANETs, Sensor Network Architectural Elements, Applications of Wireless Sensor Network, Technologies for Wireless Sensor Network, Medium Access Control Protocols, Routing Protocols, Transport Control Protocols, Design Issues

Unit 2:

Ad Hoc Networks

Background of Ad hoc wireless networks, Architecture of Ad Hoc Networks, Application of Ad Hoc sensor networks, Protocols of Ad Hoc Networks, Issues in Ad Hoc wireless networks, MANET, VANET, Comparison between Wireless Ad Hoc and Sensor Networks

UNIT-III

Overview of Internet of Things

IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT,M2M communication, Examples of IoT. Modified OSI Model for the IoT/M2M Systems, data enrichment, data consolidation and device management at IoT/M2M Gateway, web communication protocols

used by connected IoT/M2M devices, Message communication protocols (CoAP-SMS, CoAP-MQ, MQTT,XMPP) for IoT/M2M devices.

UNIT-IV

Architecture and Design Principles for IoT

Internet connectivity, Internet-based communication,IPv4, IPv6,6LoWPAN protocol, IP Addressing in the IoT, Application layer protocols: HTTP, HTTPS,FTP,TELNET and ports. Data Collection, Storage and Computing using a Cloud Platform: Introduction, Cloud computing paradigm for data collection, storage and computing, Cloud service models, IoT Cloud- based data collection, storage and computing services using Nimbits.

Course Outcomes

1. Assess the applicability and limitations of communication protocols for a real time WSN application.
2. Confirms the behavior of mobile ad hoc networks (MANETs)and correlates the infrastructure based networks.
3. Proactive in understating the routing protocols function and their implications on data transmission delay and bandwidth.
4. Able to establish networks with an attempt to reduce issue of broadcast and flooding techniques.
5. Contribute appropriate algorithms to improve existing or to develop new wireless sensor network applications.
6. Familiarize the protocol, design requirements, suitable algorithms, and the state-of-the-art cloud platform to meet the industrial requirement.

Text Books

1. Kazem Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Networks: Technology, Protocols, and Applications, Wiley Student Edition.
1. C.S. Raghavendra, Krishna M. Sivalingam and Taieb Znati, Wireless Sensor Networks, Springer International Edition.
2. Raj Kamal, Internet of Things-Architecture and design principles, McGraw Hill Education.

Reference Books

1. Holger Karl & Andreas Willig, “Protocols And Architectures for Wireless Sensor Networks”, John Wiley, 2005.
2. Jun Zheng, Abbas Jamalipour, “Wireless Sensor Networks: A Networking Perspective”, 2014, 1st ed., Wiley-IEEE Press, USA.

Web Resources

1. NPTEL course on Wireless Ad-hoc sensor networks: https://nptel.ac.in/courses/106/105/106105160/
2. NPTEL Course on Introduction to Internet of things: https://nptel.ac.in/courses/106/105/106105166

M.Tech (Digital Communication)

INDUS UNIVERSITY, AHMEDABAD

M.Tech (Digital Communication) SEMESTER-I

Sr. No.	Sub. Code	Name of Subject	Credit	Teaching scheme (per week)				Theory		Practical		Total Marks
								CIE	End Sem	CIE	End Sem	
				Th.	Tut.	Pr.	Total (hr.)	Th.	Th.	Pr.	Pr.	
1	DC0101	Mathematical Foundation of Digital Communication	4	3	2	0	5	60	40	0	0	100
2	DC0102	Multirate Signal Processing	4	3	0	2	5	60	40	60	40	200
3	DC0103	Advanced Digital Communication	4	3	0	2	5	60	40	60	40	200
4	DC0104	RF and Microwave Engineering	4	3	0	2	5	60	40	60	40	200
5	DC0105	Advanced Computer Network	4	3	0	2	5	60	40	60	40	200
6	DC0106 /DC0107	Elective-1 : Digital Satellite Communication / Elective-1 : Optical Networks	4	3	2	0	5	60	40	0	0	100
TOTAL			**24**	**18**	**4**	**8**	**30**	**360**	**240**	**240**	**160**	**1000**

INDUS UNIVERSITY, AHMEDABAD

M.Tech (Digital Communication) SEMESTER-II

Sr. No.	Sub. Code	Name of Subject	Credit	Teaching scheme (per week)				CIE	End Sem	Practical CIE	Practical End Sem	Total Marks
				Th.	Tut.	Pr.	Total (hr.)	Th.	Th.	Pr.	Pr.	
1	DC0201	Advanced Coding Theory	4	3	2	0	5	60	40	0	0	100
2	DC0202	Antenna Theory	4	3	0	2	5	60	40	60	40	200
3	DC0203	Spread Spectrum Communication	4	3	0	2	5	60	40	60	40	200
4	DC0204	Digital Design with FPGA	4	3	0	2	5	60	40	60	40	200
5	DC0205	Elective-2 Adhoc Sensor Networks / Elective-2 Digital Speech Processing	4	3	0	2	5	60	40	60	40	200
6	DC0206/ DC0207	Elective-3 DSP processor & Architecture / Elective-3 Advance Image Processing	4	3	0	2	5	60	40	60	40	200
TOTAL			**24**	**18**	**2**	**10**	**30**	**360**	**240**	**300**	**200**	**1100**

INDUS UNIVERSITY, AHMEDABAD

M.Tech (Digital Communication) SEMESTER-III

Sr. No.	Sub. Code	Name of Subject	Credit	Teaching scheme (per week)				Theory		Practical		Total Marks
				Th.	Tut.	Pr.	Total (hr.)	CIE Th.	End Sem Th.	CIE Pr.	End Sem Pr.	
1	DC0301	Dissertation Phase-1	14	0	0	28	28	60	40	0	0	100
TOTAL			**14**	**0**	**0**	**28**	**28**	**60**	**40**	**0**	**0**	**100**

INDUS UNIVERSITY, AHMEDABAD

M.Tech (Digital Communication) SEMESTER-IV

Sr. No.	Sub. Code	Name of Subject	Credit	Teaching scheme (per week)				Theory		Practical		Total Marks
				Th.	Tut.	Pr.	Total (hr.)	CIE Th.	End Sem Th.	CIE Pr.	End Sem Pr.	
1	DC0401	Dissertation Phase-1	14	0	0	28	28	60	40	0	0	100
TOTAL			**14**	**0**	**0**	**28**	**28**	**60**	**40**	**0**	**0**	**100**

SEMESTER-I
SYLLABUS

Indus University
Indus Institute of Technology & Engineering

Electronics and Communication Engineering Department

Subject Code	Subject Name		Teaching Learning				
			Theory Session (Hours)	Tutorial Session (Hours)	Laboratory Session (Hours)	Total (Hours)	Credit
DC0101	Mathematical Foundation of Digital Communication		3	2	0	5	4
DC0102	Multirate Signal Processing		3	0	2	5	4
DC0103	Advanced Digital Communication		3	0	2	5	4
DC0104	RF and Microwave Engineering		3	0	2	5	4
DC0105	Advanced Computer Network		3	0	2	5	4
DC0106/DC0107	Elective-1	Digital Satellite Communication	3	2	0	5	4
		Optical Networks					
Total			**18**	**04**	**08**	**30**	**24**

Subject: Mathematical Foundation of Digital Communication								
Program: M.Tech. Digital Communication				**Subject Code:** DC0101			**Semester:** I	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	0	4	24/60	0	16/40	0	100

Course Outcomes:

1. To equip the students with the mathematical skills required in understanding the digital communication topics being covered in the program
2. To provide the students necessary skills to solve theoretical and practical problems in the theory and engineering projects undertaken during the program 3. To enable the students to optimize their engineering solutions

UNIT-I **[12]**

Introduction to Probability and Stochastic Processes: Notion of multiple Discrete and Continuous Random Variables, Stochastic Processes, Sum of Random Variables, Statistical Inference, Gaussian Q-function, Marcum Q function;

UNIT-II **[12]**

Linear Equations, Matrices, Vector Spaces, Basis and Dimensions, Linear Mappings, Matrices and Linear operators, Determinants, Eigen values and Eigen vectors;

Partial Differential equations: Method of separation of variables, Orthogonal functions, series expansion

Groups, Rings and Fields, Vector Spaces and Modulus, Field Theory, Algebraic extensions;

UNIT-III **[12]**

Introduction to Queuing Theory and Number Theory Finite Difference Time Domain method, Finite Element method, Method of Moment, Mode matching techniques. Optimization techniques: Linear Programming problems, mathematical modeling of LPP, graphical method, simplex method, Transportation problem. Particle swarm optimization.

UNIT-IV **[12]**

Special functions: Harmonic function, Bessel‟s function, Neuman‟s function, Hankel‟s function, Legendre‟s polynomials, Greens functions.

Text Books:

1. A.Papoulis, Probability Random Variables and stochastic Processes, 2nd Ed Mc Graw Hill
2. Numerical methods in science & engineering, Dr. M.K Venkataraman, The national pub. Co. 1991.

Reference Books:

1. Numerical methods for scientific and engineering computation, M.K Jain, S.R.K Iyengar and R,K Jain , Wiley Eastern Ltd, 1987
2. Field Computation by Moment Methods, R. F. Harrington, IEEE Press.
3. Numerical methods in Electromagnetism by M.V.K Chari, S.J.Salon, Academic Press.
4. The method of Moments in Electromagnetic by Walton C Gibson, Chapman & Hall/CRC, A Taylor and Francis Group.
5. Introductory Numerical analysis by S. S. Sastry, PHI
6. Numerical methods by Douglas Faires, Richard L. Burden. Brooks/Cole
7. Operations Research by Hiller and Lieberman. TMH

Subject: Multirate Signal Processing		
Program: M.Tech. Digital Communication	**Subject Code:** DC0102	**Semester:** I

Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)-Theory**	**Continuous Internal Evaluation (CIE)-Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Outcomes:

Multirate signal processing (DSP) is at the heart of many applications in a wide array of fields: speech and audio processing, system monitoring and fault detection, biomedical signal analysis, mobile and internet communications, radar and sonar, vibration measurement and analysis, seismograph analysis, image/video coding and decoding, etc.

The objective of this course is to strengthen students' knowledge of MSP fundamentals and familiarize them with practical aspects of MSP algorithm development and implementation.

UNIT-I **[12]**

Fundamentals of Multirate Theory: The sampling theorem, sampling at sub-Nyquist rate, Basic Formulations and schemes, Basic Multirate operations, Decimation and Interpolation, Digital Filter Banks, DFT Filter Bank, Identities,Polyphase representation. Maximally decimated filter banks: Polyphase representation, Errors in the QMF bank, Perfect Reconstruction (PR) QMF Bank, Design of an alias free QMF Bank

UNIT-II **[12]**

M-channel perfect reconstruction filter banks: Uniform band and non uniform filter bank, tree structured filter bank, Errors created by filter bank system, Polyphase representation, perfect reconstruction systems

UNIT-III **[12]**

Perfect reconstruction (PR) filter banks: Para-unitary PR Filter Banks, Properties, Two channel FIR Para-unitary QMF Bank, Linear phase PR Filter banks, Necessary conditions for Linear phase property.

UNIT-IV **[12]**

Cosine Modulated filter banks: Cosine Modulated pseudo QMF Bank, Alias cancellation, Phase distortion, Closed form expression, Polyphase structure, PR Systems. Wavelet transform

Quantization Effects: Types of quantization effects in filter banks, coefficient sensitivity effects, dynamic range and scaling.

Text Books:

P. P. Vaidyanathan, „Multirate Systems and Filter Banks', Pearson

Reference Books:

Crochiere, Ronald E.; Rabiner, Lawrence R. (1983). Multirate Digital Signal Processing. Prentice-Hall.

Subject: Advanced Digital Communication		
Program: M.Tech. Digital Communication	**Subject Code:** DC0103	**Semester:** I

Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	5	24/60	24/60	16/40	16/40	200

Course Outcomes:

1. To introduce signal space and vector space concepts of signal representation.
2. To study the optimum receiver architectures for demodulation of digitally modulated signals.
3. To compute the performance of digital signals received through AWGN channels

UNIT-I **[12]**

Introduction to communication signals and systems, Low pass and Band pass representation of signals, Signal space representation, Gram-Schmidt orthogonalization procedure

UNIT-II **[12]**

Digital Modulation Techniques: Baseband modulation: Pulse amplitude modulation (binary and M-ary PAM, QAM) Bandpass modulation (M-ary ASK, PSK, FSK, DPSK), Continuous phase modulation (QPSK and variants, MSK, GMSK). Power spectral density of baseband and band pass signals

UNIT-III **[12]**

Demodulation and detection: Optimum receiver: Matched filter demodulator, Correlator demodulator, Binary Detection, Optimum rule for ML and MAP detection, Performance, Bit-errorrate, symbol error rate for coherent and non-coherent schemes. M-ary detection, 4-PAM, QPSK and M-ary PAM detection, Gray coding, Performance.

UNIT-IV **[12]**

Baseband signaling, Inter symbol interference, Pulse shape design for channels with ISI, Nyquist pulse, Partial response signaling (duo-binary and modified duo-binary pulses), Equalization techniques, Linear and Non-linear equalizers

Special modulation techniques: Spread Spectrum Modulation, OFDM modulation, Trellis coded modulation

Text Books:

1. R.N.Mutagi, „Digital Communication, Theory, Techniques and Applications‟, Oxford University Press, Nov 2011
2. J.M.Wozencraft, and I.M.Jacobs, „Principles of Communication Engineering‟, Wiley, NY 1965

Reference Books:

1. M. K. Simon, S. M. Hinedi and W. C. Lindsey, „Digital Communication Techniques: Signaling and detection‟, Prentice Hall India, N. Delhi, 1995.

2. E.A.Lee, D.G.Messerschmitt, „Digital Communication', Kluwer Academic Publishers

Subject: RF & Microwave Engineering								
Program: M.Tech. Digital Communication				**Subject Code:** DC0104			**Semester:** I	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Outcomes:

1. Understand different microwave components and study their characteristics.
2. To be able to measure the characteristics of RF and microwave circuits

UNIT-I **[12]**

Transmission line: introduction to two wire transmission line. Microstrip line, parallel strip line, coplanar strip line, shielded strip line. Smith chart: derivation and application.

UNIT-II **[12]**

Waveguides: Rectangular waveguide, Circular waveguide, dielectric waveguide and corrugated wave guide.

UNIT-III **[12]**

RF and Microwave passive components and resonator: basic properties of dividers and coupler (Two-port and Four-port network) E-planeT, H-plane T, magic-T, circulator, isolator, directional coupler ,Wilkinson power divider. Resonators: transmission line resonator, waveguide resonator, dielectric resonator, aperture coupled resonator..

UNIT-IV **[12]**

Noise Figure of Microwave Components: measurements of noise temperature, Noise figure of a cascaded system, Noise figure of a passive two-port network, noise figure of mismatched lossy line

Microwave Amplifiers, Oscillator and Mixers: single stage transistor amplifier design, broad band transistor amplifier design and power amplifier, RF oscillators, microwave oscillators, noise consideration in oscillators, mixer characteristics, diode mixer, FET mixer, Balanced mixer, Image rejection mixer.

Text Books:

David M Pozer, „Microwave Engineering", Wiley India Edition. 2. S Y Liao, „Microwave device and circuits", PHI

Reference Books:

1. Ramo, S., Whinnery J.R., and van Duzer, T, „Fields and Waves in Communication Electronics", 3rd ed., Wiley Eastern
2. Atwater, „Microwave Theory" McGraw-Hill
3. R. R. Collin, „Foundations for Microwave Engineering", McGraw Hill

Subject: Digital Satellite Communication		
Program: M.Tech. Digital Communication	**Subject Code:** DC0106	**Semester:** I

Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	0	4	24/60	0	16/40	0	100

Course Outcomes:

To understand the principles of modern satellite communication systems

UNIT-I **[12]**

Introduction: Frequency bands, Satellite orbits, Elements of satellite communication, Satellite subsystems 2 Orbital mechanics: Orbital period and velocity, Effects of inclination, azimuth and Elevation, Coverage angle and slant range, Eclipse and outages

UNIT-II **[12]**

Earth stations Technology: Antennas, Gains, G/T, RF sub systems, Baseband sub systems 4 Satellite link design: Link equation, C/N ratio at the receiver, Interferences, Path loss, Propagation effects, Polarization, Frequency reuse

UNIT-III **[12]**

Satellite Multiple Access Techniques: Frequency Division Multiple Access, Satellite TDMA, Satellite switched TDMA, Synchronization techniques, Spread Spectrum Multiple Access, Demand Assigned Multiple Access, Digital Speech Interpolation

UNIT-IV **[12]**

Digital modulation and Coding Techniques: PSK, OQPSK, MSK, Block error codes, Convolutional codes, RS codes, Concatenated coding 7 Satellite Systems: Fixed satellite systems, Broadcast systems, Mobile systems

Text Books:

T.T.Ha, „Digital Satellite Communication', Mc Graw Hill

Reference Books:

M.Richharia, „Satellite Communication Systems', Mc Graw Hill

Subject: Optical Networks		
Program: M.Tech. Digital Communication	**Subject Code:** DC0107	**Semester:** I

Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)-Theory**	**Continuous Internal Evaluation (CIE)-Practical**	**Total**
3	2	0	4	24/60		16/40		100

Course Outcomes:

To develop skills and knowledge required to understand the fundamentals of optical networks To be able to solve technical problems in the following areas:

1. Fundamental optical network elements;
2. Optical network architectures ranging from optical access networks to backbone optical transport networks;
3. Approaches and methodologies of optical network design optimization;
4. Techniques of optical network survivability;

UNIT-I **[12]**

Optical Networking-Introduction and Challenges:

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 Networking Components/Building Blocks: Optical transmitters, semiconductor laser diode, tunable and fixed laser, laser characteristics, photodectors, 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-II **[12]**

Single and Multi-hop Networks:

Introduction to single and multi-hop networks, Characteristics of single and multi-hop networks, experimental single hop networks: LAMBDANET, STARNET, SONATA, Rainbow, experimental multihop networks: Shufflenet, De Bruijn Graph, Hypercube

UNIT-III **[12]**

Optical switching :

Optical packet switching basics, slotted and unslotted networks, header and packet format, contention resolution in OPS networks, self routing, examples on OPS node architecture, optical burst switching, signaling and routing protocols for OBS networks, contention resolution in OPS networks, multicasting, implementation and application. MEMs based switching, switching with SOAs

Optical Access Network:

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.

UNIT-IV **[12]**

Optical Metro Networks:

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, protectoration and network lifetime.

Optical Multicasting and traffic grooming:

Introduction to multicasting, Multicastcapable switch architecture, unicast, broadcast and multicast traffic, multicast tree protection, traffic grooming overview, static and dynamic traffic grooming

Text Books:

1. Data Communication by BehrouzÂ A Forouzan, Mc Graw Hill, 4th ed.
2. Optical Switching by Tarek S. El. Bawab, Springer.

Reference Books:

1. Optical Network Series by Biswanath Mukherjee, Springer, 2006.
2. Optical Networks by R.Ramaswami and K.Sivarajan, Â Morgan Kaufmann Publishers, 2nd ed., 2002.
3. Optical Switching Networks by Mayer & Martin, Cambridge University Press, 2008

SEMESTER-II

Indus University
Indus Institute of Technology & Engineering

Electronics and Communication Engineering Department

Teaching Scheme

Subject Code	Subject Name		Teaching Learning				Credit
			Theory Session (Hours)	Tutorial Session (Hours)	Laboratory Session (Hours)	Total (Hours)	
DC0201	Advanced Coding Theory		3	2	0	5	4
DC0202	Antenna Theory		3	0	2	5	4
DC0203	Spread Spectrum Communication		3	0	2	5	4
DC0204	Digital Design with FPGA		3	0	2	5	4
DC0205 /DC0206	Elective-2	Digital Speech Processing / Adhoc Sensor Networks	3	0	2	5	4
DC0207 /DC0208	Elective-3	DSP processor & Architecture / Advance Image Processing	3	0	2	5	4
	Total		**18**	**04**	**10**	**30**	**24**

Subject: Advanced Coding Theory		
Program: M.Tech. Digital Communication	**Subject Code:** DC0201	**Semester:** II

Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	0	4	24/60	0	16/40	0	100

Course Outcomes:

1. To study various advanced error correcting codes
2. To be able to design digital communication systems with error control

UNIT-I **[12]**

Coding for reliable digital Transmission & Storage: Types of codes, Modulation & coding, Types of errors, Performance measures, Coded modulation

UNIT-II **[12]**

Linear Block Codes: Introduction of Linear block codes, Encoding and decoding of linear block codes, Syndrome and error detection, Error detection and correcting capabilities, Hamming codes, Golay codes, Performance of linear codes Class of single error correcting and double error detecting codes, Reed- muller codes, Product code, Low density codes

UNIT-III **[12]**

Cyclic Codes and BCH code: Cyclic encoding, Syndrome decoding, Shortened cyclic codes, BCH codes, Decoding of BCH codes, Reed Solomon (RS)codes, Decoding of RS codes

UNIT-IV **[12]**

Convolutional codes: Encoding of convolutional codes, The viterbi algorithm, Implementation and performance of viterbi decoder, Soft output viterbi decoder, Softdecision decoding performance, Hard-decision decoding performance, Viterbi

algorithm implementation issues: RSSE, trellis truncation, cost, normalization Sequential decoding: Stack, Fano, feedback decision decoding

Text Books:

Lin shu,Shu lin and Daniel Costello, „Error control coding'

Reference Books:

1. Todd k.Moon, „Error correcting coding: mathematical Methods & algorithms'
2. W.Wesley Peterson & E.J. Weldson ,Jr, „Error –correcting codes"

Subject: Antenna Theory		
Program: M.Tech. (DC)	**Subject Code:** DC0202	**Semester:** II

Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	2	2	5	24/60	24/60	16/40	16/40	200

Course Outcomes :

1. The objective of this subject is to deliver an in-depth knowledge of the basic & advanced antennas.
2. Also give the practical design consideration and simulation of various antennas for different applications.

UNIT-I **[12]**

Overview of Electromagnetic:

Maxwell's equations, Radiation integrals & auxiliary potential function, Electromagnetic potential, Boundary value problems, Plane, cylindrical and Spherical waves, electromagnetic theorems, overview of Antennas parameters, Field zones, Dipole antennas.

UNIT-II **[10]**

Arrays of Antennas:

Two-element array, N-element linear array, array/space factor, broadside array, end-fire array, binomial array, Dolph-Tschebyscheff array, planar array, slotted waveguide array, microstrip array, helical array, active phased array and adaptive arrays.

UNIT-III **[10]**

Aperture antennas: Field equivalence principle: Huygens principle, radiation equations, rectangular apertures, circular apertures, Babinet's principle, introduction to diffraction of fields

Horn antennas: E-plane sectoral horn, aperture fields, radiated fields, directivity, H-plane sectoral horn, aperture fields, radiated fields, directivity, pyramidal horn, conical horn, corrugated horn, phase centre calculation in horn antennas.

UNIT-IV **[13]**

Reflector antennas:

Plane reflector, corner reflector, parabolic reflector, front fed parabolic reflector, dual symmetrical and offset reflectors (Cassegrain & Gregorian antenna).

Advancement of antenna types:

Microstrip antennas, helical antennas, Fractal antenna, electronic bandgap antenna, Metamaterials, fractal antennas, surface wave antenna.

Text Books:

1. Antenna Theory: Analysis and Design, 3rd Edition, C A Balanis, Wiley Publication.
2. Antennas, J D Krauss, Mcgraw-Hill Higher Education.

Reference Books:

1. Electromagnetic Wave and Radiating Systems, Edward C. & Balmain, Keith G. Jordan. Prentice Hall of India.
2. Electronic and Radio Engineering, F.E. Terman, McGraw-Hill, 4th edition, 1955.

Subject: Spread Spectrum Communication		
Program: M.Tech. Digital Communication	**Subject Code:** DC0203	**Semester:** II

Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)-Theory**	**Continuous Internal Evaluation (CIE)-Practical**	**Total**
3	2	2	4	24/60	24/60	16/40	16/40	200

Course Outcomes:

1. To introduce the concept of spread spectrum modulation
2. To study the applications of spread spectrum modulation in multiple access
3. To compute the performance and capacity of spread spectrum systems
4. To compare the types of spread spectrum techniques

UNIT-I **[12]**

Basics of spread spectrum: Concept, origin, advantages of spreading

UNIT-II **[12]**

Spreading codes:
PRBS, Properties, Autocorrelation and power spectrum, characteristic polynomials, Gold codes, cross correlation, generation

UNIT-III **[12]**

Direct sequence Spread Spectrum Systems with BPSK modulation, QPSK system, Interference Rejection, Frequency Hopping Spread Spectrum Concept, Fast and slow hopping systems and performance

UNIT-IV **[12]**

Acquisition techniques, Sequential acquisition, Calculation of mean time for acquisition, Sweep strategies, Parallel acquisition, RASE system, Delay lock loop, Multiple Access,:CDMA, Digital cellular systems

Text Books:

1. Roger L. Peterson, Rodger E. Ziemer, David E. Borth, Introduction to spread-spectrum communications, Prentice Hall
2. Andrew J. Viterbi, CDMA: Principles of Spread Spectrum Communication, Addison Wesley

Reference Books:

1. Don Torrieri, Principles of Spread Spectrum Communication Systems, Springer

2. Marvin K. Simon, Jim K. Omura, Robert A. Scholtz, Barry K. Levitt, Spread Spectrum Communication Handbook, McGraw Hill

Subject: Digital Design with FPGA								
Program: M.Tech. Digital Communication				**Subject Code:** DC0204			**Semester:** II	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Outcomes:

1. To introduce the concept of FPGA
2. To study HDL languages (Verilog and VHDL)

To study how complex digital system can be designed.

UNIT-I **[12]**

Digital system design options and trade offs Design methodology and technology overview

UNIT-II **[12]**

Overview of Digital Design with HDL

UNIT-III **[12]**

Verilog & VHDL Languages

UNIT-IV **[12]**

Overview of FPGA architectures and technologies

Text Books:

1. VHDL, Analysis and Modeling of Digital Systems by Navabi, Z. Second Edition, McGraw-Hill, New York, (1998).
2. Verilog hdl: A guide to digital design and synthesis, second edition by Samir Palnitkar, Prentice Hall of India.
3. Application Specific Integrated Circuit by M.J.S. Smit, Pearson, 2000.

Reference Books:

1. A VHDL Primer by J. Bhasker, Prentice Hall of India

Subject: Digital Speech Processing		
Program: M.Tech. Digital Communication	**Subject Code:** DC0205	**Semester:** II

Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Outcomes:

1. To master the theory and technologies behind speech related products
2. To acquire knowledge and perform evaluations of Speech analysis, speech synthesis, speech coding and speech recognition systems.

UNIT-I **[12]**

Speech Communication: Introduction, discrete-time speech signal processing, speech communication, review of signals and linear systems

Speech production and acoustic phonetics: Anatomy and physiology of speech organs, speech sounds and classification, International Phonetic Alphabet (IPA), Articulatory Phonetics: Manner of articulation and place of articulation, vowel triangle, Acoustic Phonetics: spectrograms, wide-band and narrow-band spectrograms, acoustic characteristics of speech sounds, coarticulation and prosody

UNIT-II **[12]**

Time-domain models for speech processing: Introduction to short-time speech analysis, windowing, short-time energy and average magnitude, short-time Zero-Crossing Rate (ZCR), speech vs. silence discrimination using energy and zero crossings, short-time autocorrelation function, short-time Average Magnitude Difference Function (AMDF)

Short-time Fourier analysis: Short-time Fourier transform (STFT), spectral displays, time-frequency resolution tradeoffs, Linear filtering interpretation, short-time synthesis, filter bank summation method

UNIT-III **[12]**

Linear Predictive Coding of Speech: Basic principles of Linear predictive analysis, autocorrelation method and covariance method, computation of gain for the model, prediction error signal, frequency domain interpretation of LP analysis, frequency domain interpretation of mean-squared prediction error, applications of LPC parameters

UNIT-IV **[12]**

Homomorphic Signal Processing: Concept of Homomorphic processing, Homomorphic systems for convolution, properties of complex cepstrum, Homomorphic filtering, complex cepstrum of voiced speech, complex cepstrum of unvoiced speech, Mel-scale cepstrum

Text Books:

1. D O'shaughnessy, Speech Communication: Human and Machine, Addison Wesley.
2. L R Rabiner and R W Schafer, Digital Processing of Speech Signals, Prentice Hall

Reference Books:

1. J Flanagan, Speech Analysis, Synthesis, and Perception, Springer Verlag.
2. T. Quatieri, Discrete-time Speech Signal Processing, Pearson Education

Subject: Adhoc Sensor Networks								
Program: M.Tech. Digital Communication			**Subject Code:** DC0206				**Semester:** II	
Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Outcomes:

1. To introduce the students to wireless ad hoc networks and wireless sensor networks.
2. To expose the architecture, applications, networking protocols and management issues
3. To learn applications, communication and networking protocols, middleware, security, and management of wireless sensor networks
4. To understand the benefits of this new technology and plan for its use and deployment.

UNIT-I **[12]**

Introduction to Wireless Ad Hoc Networks: Background of Ad hoc wireless networks, Architecture of Ad Hoc Networks, Application of Ad Hoc sensor networks, Protocols of Ad Hoc Networks, Issues in Ad Hoc wireless networks. Comparison between Wireless Ad Hoc and Sensor Networks

UNIT-II **[12]**

Basics of Wireless Sensor Network: Background of Sensor Network Technology, MANETs, Sensor Network Architectural Elements, Applications of Wireless Sensor Network, Technologies for Wireless Sensor Network

UNIT-III **[12]**

Wireless Sensors Networks Protocols: Medium Access Control Protocols, Routing Protocols, Transport Control Protocols, Dissemination protocol for Large sensor Networks, Reliable Transport for Sensor networks.

Localization and Management of Sensor Networks: Localization in Sensor networks, Network Management Requirements, Network Management Models, Design Issues, Energy Harvesting in Sensor Network

UNIT-IV **[12]**

Control Aspect in Sensor Networks: Congestion control, Distributed Power Control, Admission Controller Design for High Speed Networks, Performance evaluation of the Architecture

Security in WSN: Security Issues in WSN, Key Distribution Techniques in WSN, and watermarking techniques in Wireless Sensor Networks

Text Books:

1. Kazem Sohraby, Daniel Minoli, Taieb Znati, Wireless Sensor Networks: Technology, Protocols, and Applications, Wiley Student Edition.
2. C.S. Raghavendra, Krishna M. Sivalingam and Taieb Znati, Wireless Sensor Networks, Springer International Edition.

Reference Books:

1. C.Sivaramamurthy and B.S.Manoj, Ad hoc Wireless Sensor Networks: Architecture and Protocols, Pearson Education.
2. Jagannathan Sarangapani, Wireless Ad Hoc and Sensor Networks Protocols, Performances and Control, CRC Press.

Subject: DSP processor & Architectures		
Program: M.Tech. Digital Communication	**Subject Code:** DC0207	**Semester:** II

Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)-Theory**	**Continuous Internal Evaluation (CIE)-Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Outcomes:

1. To understand Digital Signal Processing techniques, systems and applications.
2. To introduce the students to Programmable DSPs.
3. To study the Architecture and Instruction set of TMS320C5X and TMS320C5X DSP processors.

UNIT-I **[12]**

Overview of Digital Signal Processing: Digital signals and operations, Digital systems: LTI systems, Finite-Impulse Response filters, Infinite-Impulse Response filters, Frequency Analysis of signals: Discrete-Time Fourier Transform, Discrete Fourier Transform, Fast Fourier Transform, The z-transform

Digital Signal Processing Systems: Advantages of DSP systems, Characteristics of DSP systems, Classes of DSP applications

.**UNIT-II** **[12]**

Introduction to Programmable DSPs: Multiplier and Multiplier Accumulator (MAC), modified bus structures and memory access schemes in P-DSPs, Multiple Access Memory, VLIW architecture, Pipelining, Special addressing modes in P-DSPs, On-Chip Peripherals

UNIT-III **[12]**

Architecture and Instruction set of TMS320C5X: Introduction, Bus Structure, Central ALU, Auxiliary Register ALU, Index Register, Auxiliary Register ALU, Block Move Address Register, Block repeat registers, parallel logic unit, memory-mapped registers, program controller, flags in status register, on-chip memory, on-chip peripherals, Assembly Language Syntax, Addressing Modes and instructions, pipelining in C5x

UNIT-IV **[12]**

Architecture and Instruction set of TMS320C6X: Introduction, TMS320C6X architecture, Functional Units, Pipelining, registers, Addressing Modes and Instruction set, Timers, Interrupts, Multichannel Buffered serial ports

Text Books:

1. B. Venkataramani, M. Bhaskar “Digital Signal Processors: Architecture, Programming and Applications”, Tata McGraw-Hill
2. Sen M. Kuo, Woon-Seng S. Gan, “Digital Signal Processors: Architectures, Implementations and Applications”, Pearson Education

Reference Books:

1. TMS320C6000 CPU and Instruction Set, SPRU189F, Texas Instruments, Dallas, TX, 2000

Subject: Advanced Image Processing		
Program: M.Tech. Digital Communication	**Subject Code:** DC0208	**Semester:** II

Teaching Scheme				**Examination Evaluation Scheme**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	24/60	24/60	16/40	16/40	200

Course Outcomes:

1. To introduce the digital image processing algorithms
2. Develop hands-on experience in using computers to process images
3. Familiarize with MATLAB Image Processing Toolbox
4. Develop critical thinking about shortcomings of the state of the art in image processing

UNIT-I **[12]**

Introduction: Elements of visual perception, Image sensing & Acquisition ,Image sampling & Quantization ,Relation between pixels, Arithmetic operation ,Logical operation. Image transforms: DFT,DCT ,Hadmard, Haar, Slant ,KL

Image Enhancement: Enhancement by point processing ,Intensity Transformation, Histogram Processing ,Smoothing spatial filtering, Sharpening spatial filtering ,Smoothing image using frequency domain filtering , Sharpening image using frequency domain filtering, color image enhancement.

UNIT-II **[12]**

Image restoration: A model of the image degradation/Restoration Process, Noise model, Restoration in presence of noise using spatial and frequency filtering ,Inverse & wiener filter, Smoothing ,splines & Interpolation ,Blind deconvolution.

Color image processing: color models, pseudocolor image processing, color transformation, Image segmentation based on color.

UNIT-III **[12]**

Morphological image: dilation & erosion, The Hit –or- Miss transformation, Open & close, Morphological algorithms, Gray scale morphology.

Image segmentation: Point, line and edge detection, Thresholding, Region based segmentation, The use of motion segmentation

UNIT-IV **[12]**

Wavelets and multi resolution Processing. Image Compression: Fundamentals, Image compression standards, Lossy & lossless compression methods, Video compression standards, Digital Image water marking. Object recognition

Text Books:

1. Gonzalez & Wood, Digital Image Processing:, Addison-Wesley, 1993.
2. S. Sridhar**,** Digital Image Processing, 1/e, Oxford University Press

Reference Books:

1. A.K Jain, Digital Image Processing, PHI, 1995

SEMESTER-III

Indus University
Indus Institute of Technology & Engineering

Electronics and Communication Engineering Department

Teaching Scheme

Subject Code	Subject Name		Teaching Learning			
		Theory Session (Hours)	Tutorial Session (Hours)	Laboratory Session (Hours)	Total (Hours)	Credit
DC0301	Dissertation Phase-1	0	0	30	30	15

SEMESTER-IV

Indus University
Indus Institute of Technology & Engineering

Electronics and Communication Engineering Department

Teaching Scheme

Subject Code	Subject Name		Teaching Learning			
		Theory Session (Hours)	Tutorial Session (Hours)	Laboratory Session (Hours)	Total (Hours)	Credit
DC0401	Dissertation Phase-2	0	0	30	30	15