ERODE SENGUNTHAR ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University)

PERUNDURAI, ERODE - 638 057

UG Curriculum and Syllabus

(1 to 8 Semesters)

B.E – ELECTRONICS AND COMMUNICATION ENGINEERING

Choice Based Credit System (CBCS)

REGULATION 2019

ERODE SENGUNTHAR ENGINEERING COLLEGE, ERODE

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

REGULATIONS – 2019

(Students admitted from 2020-21 onwards)

CHOICE BASED CREDIT SYSTEM

I TO VIII SEMESTERS CURRICULUM

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING
Minimum credits to be earned : 160

Induction program (Mandatory)	3 weeks duration
Induction Program for the students to be offered right at the start of the first year	• Physical activity • Creative Arts • Universal Human Values • Literary • Proficiency Modules • Lecture by Eminent people • Visits to local Areas • Familiarization to Dept./Branch & Innovations

FIRST SEMESTER

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	POs	PSOs					CA	ES	Total	
19BS101	Calculus and its Applications	I,II	1,2,3, 4,12	-	3	1	0	4	40	60	100	BS
19BS102	Engineering Physics	I,II	1,2,4, 5,6,8,9	1,2	2	0	2	3	40	60	100	BS
19BS103	Engineering Chemistry	I,II	1,2,3,4 5,7,12	1,2	3	0	0	3	40	60	100	BS
19ES101	Python Programming	I,II,III	1,2,3, 4,12	-	3	0	0	3	40	60	100	ES
19HS101	Communicative English	III	2,3,6, 9,10, 12	-	3	0	0	3	40	60	100	HS
19TPS01	Soft Skills - I	III	8,9, 10,12	-	1	0	1	1.5	40	60	100	EEC
PRACTICALS												
19BS105	Chemistry Laboratory	I,II	1,2,3,4 ,5,12	-	0	0	4	2	60	40	100	BS
19ES104	Python Programming Laboratory	I,II,III	1,2,3,4 ,5, 12	-	0	0	2	1	60	40	100	ES
19ES106	Engineering Graphics	I,II	1,2,3,5 10,12	1	0	0	4	2	60	40	100	ES
				TOTAL	15	1	13	22.5	420	480	900	-

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SECOND SEMESTER												
Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	POs	PSOs					CA	ES	Total	
19BS201	Vector Calculus and Complex Variables	I,II	1,2,3,4,12	-	3	1	0	4	40	60	100	BS
19ES202	Advanced C Programming	I,II,III	1,2,3,4,12	-	3	0	0	3	40	60	100	ES
19ES205	Electrical Engineering	I,II,III	1,2,3,4,5,6,11,12	1,2	3	0	0	3	40	60	100	ES
19ES208	Analog Electronics-I	I,II,III	1,2,3,4,5,6,11,12	1,2	3	0	0	3	40	60	100	PC
	Language Elective	I,IV	2,3,6,9,10,12	-	3	0	0	3	40	60	100	HS
19MC201	Environmental Science and Engineering	I,IV	1,2,3,4,5,6,7,8,12	-	3	0	0	0	40	60	100	MC
19TPS02	Soft Skills - II	III	8,9,10,12	-	1	0	1	1.5	40	60	100	EEC
PRACTICALS												
19ES214	Advanced C Programming Laboratory	I,II,III	1,2,3,4,12	-	0	0	4	2	60	40	100	ES
19ES219	Devices Laboratory	I,II,III	1,2,3,4,5,11,12	1,2	0	0	2	1	60	40	100	PC
				Total	19	1	7	20.5	400	500	900	-

THIRD SEMESTER												
Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	POs	PSOs					CA	ES	Total	
19BS301	Applied Linear Algebra	I,II	1,2,3,4	-	3	1	0	4	40	60	100	BS
19EC301	Analog Electronics-II	I,II,III	1,2,3,4,5,6,11,12	1,2	3	0	0	3	40	60	100	PC
19EC302	Digital Electronics	I,II,III	1,2,3,4,5,6,11,12	1,2	3	0	0	3	40	60	100	PC
19EC303	Signals and Systems	I,II,III	1,2,3,4,5,6,11,12	1,2	3	1	0	4	40	60	100	PC
19EC304	Network Theory	I,II,III	1,2,3,4,5,6,12	1,2	3	1	0	4	40	60	100	ES

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19MC301	Indian Constitution	I,IV	6,8,10, 11,12	3	2	0	0	0	40	60	100	MC
19TPS03	Quantitative Aptitude and Logical Reasoning - I	I,IV	1,2,9, 10,12	-	2	0	0	0	40	60	100	EEC
PRACTICALS												
19EC305	Analog Electronics Laboratory	I,II,III	1,2,3, 4,5,6, 11,12	1,2	0	0	2	1	60	40	100	PC
19EC306	Digital Electronics Laboratory	I,II,III	1,2,3, 4,5,6, 11,12	1,2	0	0	2	1	60	40	100	PC
				Total	19	3	4	20	400	500	900	-

FOURTH SEMESTER

Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	POs	PSOs					CA	ES	Total	
19BS404	Probability and Stochastic Process	I,II	1,2,3, 4,12	-	3	1	0	4	40	60	100	BS
19BS407	Electromagnetics and Waveguides	I,II,III	1,2,3, 4,5,6, 11,12	1,2	3	0	0	3	40	60	100	BS
19EC401	Linear Integrated Circuits	I,II,III	1,2,3, 4,5,6, 11,12	1,2	3	0	0	3	40	60	100	PC
19EC402	Digital Signal Processing	I,II,III	1,2,3, 4,5,6, 11,12	1,2	3	1	0	4	40	60	100	PC
19EC403	Analog Communication	I,II,III	1,2,3, 4,5,6, 11,12	1,2	3	0	0	3	40	60	100	PC
19ES401	Control System Engineering	I,II,III	1,2,3, 4,5,6, 11,12	1,2	3	1	0	4	40	60	100	ES
19TPS04	Quantitative Aptitude and Logical Reasoning - II	I,IV	1,2,9, 10,12	-	2	0	0	0	40	60	100	EEC
PRACTICALS												
19HS401	Language Skills	I,IV	5,,9, 10,12	-	0	0	2	0	100	0	100	EEC
19EC404	Linear Integrated Circuits Laboratory	I,II,III	1,2,3, 4,5,6, 11,12	1,2	0	0	2	1	60	40	100	PC

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19EC405	Digital Signal Processing Laboratory	I,II,III	1,2,3, 4,5,6, 11,12	1,2	0	0	2	1	60	40	100	PC
				Total	20	3	4	23	500	500	1000	-

FIFTH SEMESTER												
Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	POs	PSOs					CA	ES	Total	
19EC501	Antennas and Wave Propagation	I,II,III	1,2,3,4 ,5,6, 11,12,	1,2	3	0	0	3	40	60	100	PC
19EC502	Digital Communication	I,II,III	1,2,3,4 ,5,6, 11,12	1,2	3	0	0	3	40	60	100	PC
19EC503	Microprocessor, Microcontroller and Interfacing	I,II,III	1,2,3,4 ,5,6, 11,12,	1,2	3	0	0	3	40	60	100	PC
	Professional Elective – I	-	--	-	3	0	0	3	40	60	100	PE
	Open Elective -I	-	-	-	3	0	0	3	40	60	100	OE
19HS402	Universal Human Values 2 : Understanding Harmony	IV	1,2,4,7 , 8,11, 12	-	3	0	0	3	40	60	100	HS
19TPS05	Quantitative Aptitude and Logical Reasoning - III	I,IV	1,2,9, 10,12	-	2	0	0	0	40	60	100	EEC
PRACTICALS												
19EC504	Microprocessor Microcontroller and Interfacing Laboratory	I,II,III	1,2,3,4 ,5,6, 11,12	1,2	0	0	2	1	60	40	100	PC
19EC505	Communication Systems Laboratory	I,II,III	1,2,3,4 ,5,6, 11,12	1,2	0	0	2	1	60	40	100	PC
19EC506	Mini Project	I,II,III.IV	1,2,3,4 ,5,6,7, 8,9,10, 11,12	-	0	0	2	1	100	0	100	EEC
19EC507	Internship /Industrial Training	I,II,III.IV	1,2,3,4 ,5,6,7, 8,9,10, 11,12	-	0	0	2	1	100	0	100	EEC
				Total	20	0	8	22	600	500	1100	-

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SIXTH SEMESTER												
Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	POs	PSOs					CA	ES	Total	
19CS403	Computer Networks	I,II,III	1,2,3, 4,8, 10,12	1,2	3	0	0	3	40	60	100	PC
19EC601	Mobile Communication	I,II,III	1,2,3,4 ,5,6, 11,12	1,2	3	0	0	3	40	60	100	PC
19EC602	CMOS VLSI Design	I,II,III	1,2,3,4 ,5,6, 11,12	1,2	3	0	0	3	40	60	100	PC
	Professional Elective – II	-	--	-	3	0	0	3	40	60	100	PE
	Open Elective-II	-	--	-	3	0	0	3	40	60	100	OE
19TPS06	Quantitative Aptitude and Logical Reasoning - IV	I,IV	1,2,9, 10,12	-	2	0	0	0	40	60	100	EEC
PRACTICALS												
19HS601	Professional Skills	I,IV	1,5,7,8 ,9,12	-	0	0	2	0	60	40	100	EEC
19EC603	VLSI Design Laboratory	I,II,III	1,2,3,4 ,5,6, 11,12,	1,2	0	0	2	1	60	40	100	PC
19CS406	Networking Laboratory	I,II,III	1,2,3,4 ,5,12	1,2	0	0	4	2	60	40	100	PC
19EC604	Comprehension Review	I,II,III.IV	1,2,3,4 ,5,6,7, 8,9,10, 11,12	-	0	0	2	0	100	0	100	EEC
				Total	17	0	10	18	520	480	1000	-

SEVENTH SEMESTER												
Code No	Course	Objective & Outcomes			L	T	P	C	Maximum Marks			Category
		PEOs	POs	PSOs					CA	ES	Total	
19EC701	Microwave Engineering	I,II,III	1,2,3, 4,5,6, 11,12	1,2	3	1	0	4	40	60	100	PC
19EC702	Optical Fiber Communication	I,II,III	1,2,3, 4,5,6, 11,12	1,2	3	0	0	3	40	60	100	PC
19EC703	Embedded and Real time Systems	--	--	-	3	0	0	3	40	60	100	PC

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Dept.of ECE - ESEC

	Professional Elective – III	-	--	-	3	0	0	3	40	60	100	PE
	Professional Elective –IV	--	--	-	3	0	0	3	40	60	100	PE
	Professional Elective – V	--	--	-	3	0	0	3	40	60	100	PE
PRACTICALS												
19EC704	Optical and Microwave Laboratory	I,II,III	1,2,3, 4,5,6, 11,12	1,2	0	0	2	1	60	40	100	PC
19EC705	Embedded and Real time Systems Laboratory	I,II,III	1,2,3, 4,5,6, 11,12	1,2	0	0	2	1	60	40	100	PC
19EC706	Project work Phase-I	I,II,III,IV	1,2,3, 4,5,6, 7,8,9, 10,11, 12	1,2,3	0	0	2	1	60	40	100	EEC
				Total	18	1	6	22	420	480	900	-

EIGTH SEMESTER												
Code No	**Course**	**Objective & Outcomes**			**L**	**T**	**P**	**C**	**Maximum Marks**			**Category**
		PEOs	**POs**	**PSOs**					**CA**	**ES**	**Total**	
	Professional Elective – VI	-	-	-	3	0	0	3	40	60	100	PE
	Professional Elective – VII	-	-	-	3	0	0	3	40	60	100	PE
PRACTICALS												
19EC801	Project Work	I,II,III,IV	1,2,3, 4,5,6, 7,8,9, 10,11 12	1,2,3	0	0	12	6	60	40	100	EEC
				Total	6	0	12	12	140	160	300	-

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Dept.of ECE - ESEC

ELECTIVES

LANGUAGE ELECTIVES								
Code No	Course	Objective & Outcomes			L	T	P	C
		PEOs	POs	PSOs				
19HX201	English for Engineers	I,IV	2,3,6,9,10,12	-	3	0	0	3
19HX202	Hindi	I,IV	2,3,6,9,10,12	-	3	0	0	3
19HX203	Japanese	I,IV	2,3,6,9,10,12	-	3	0	0	3
19HS204	French	I,IV	2,3,6,9,10,12	-	3	0	0	3

PROFESSIONAL ELECTIVES								
Code No	Course	Objective & Outcomes			L	T	P	C
		PEOs	POs	PSOs				
ELECTIVES-I								
19ECX01	Medical Electronics	I,II,III	1,2,3,4,11, 12	1,2	3	0	0	3
19ECX02	Wavelets and Multi-resolution Processing	I,II,III	1,2,3,4,11,12	1,2	3	0	0	3
19ECX03	Electrical and Electronics Instrumentation	I,II,III	1,2,3,4,11,12	1,2	3	0	0	3
19ECX04	Electromagnetic Interference and Compatibility	I,II,III	1,2,3,4,11,12	1,2	3	0	0	3
19ECX05	Speech Processing	I,II,III	1,2,3,4,11,12	1,2	3	0	0	3
ELECTIVES-II								
19ECX06	Wireless Adhoc and Sensor networks.	I,II,III	1,2,12	1,2	3	0	0	3
19ECX07	High speed networks	I,II,III	1,2,12	1,2	3	0	0	3
19ECX08	Machine Learning	I,II,III	1,2,12	1,2	3	0	0	3
19ECX09	Artificial intelligence	I,II,III	1,2,12	1,2	3	0	0	3
19ECX10	Wireless Networks	I,II,III	1,2,12	1,2	3	0	0	3
ELECTIVES-III								
19ECX11	Data Compression Techniques	I,II,III	1,2,3,4,11, 12,13,14	1,2	3	0	0	3
19ECX12	Video Analytics	I,II,III	1,2,3,4,11, 12,13,14	1,2	3	0	0	3
19ECX13	Digital Image Processing	I,II,III	1,2,3,4,11, 12	1,2	3	0	0	3
19ECX14	Biomedical Image Processing	I,II,III	1,2,3,4,11, 12,13,14	1,2	3	0	0	3
19ECX15	Statistical Signal processing	I,II,III	1,2,3,4,11, 12	1,2	3	0	0	3
ELECTIVES-IV								

Chairman - BoS
Dept.of ECE - ESEC

19ECX16	CAD for VLSI Circuits	I,II,III	1,2,3,4,5,12	1,2	3	0	0	3
19ECX17	System on Chip	I,II,III	1,2,3,4,5,12	1,2	3	0	0	3
19ECX18	Design and Analysis of Digital integrated Circuits	I,II,III	1,2,3,4,5,12	1,2	3	0	0	3
19ECX19	Low power VLSI	I,II,III	1,2,3,4,5,12	1,2	3	0	0	3
19ECX20	Testing of VLSI Circuits	I,II,III	1,2,3,4,5,12	1,2	3	0	0	3
ELECTIVES-V								
19ECX21	RF MEMS	I,II,III	1,2,5,12	1,2	3	0	0	3
19ECX22	Nano Electronics	I,II,III	1,2,5,12	1,2	3	0	0	3
19ECX23	Modern Electronic Instrumentation	I,II,III	1,2,3,4,12	1,2	3	0	0	3
19ECX24	Computer Architecture and Interfacing	I,II,III	1,2,12	1,2	3	0	0	3
19ECX25	Embedded Internet of Things	I,II,III	1,2,3,4,5, 12	1,2	3	0	0	3
ELECTIVES-VI								
19ECX26	Satellite Communication	I,II,III	1,2,12	1,2	3	0	0	3
19ECX27	Global Positioning Systems	I,II,III	1,2,12	1,2	3	0	0	3
19ECX28	Radar and Navigational Aids	I,II,III	1,2,12	1,2	3	0	0	3
19ECX29	Remote Sensing	I,II,III	1,2,12	1,2	3	0	0	3
19ECX30	Wireless system and standards	I,II,III	1,12	1,2	3	0	0	3
ELECTIVES-VII								
19ECX31	Network On Chip	I,II,III	1,2,3,4,5,12	1,2	3	0	0	3
19ECX32	Computational Electromagnetics	I,II,III	1,2,3,4,5,12	1,2	3	0	0	3
19ECX33	Cryptography and Network security	I,II,III	1,2,3,4,5,12	1,2	3	0	0	3
19ECX34	Cognitive Radio	I,II,III	1,2,3,4,5,12	1,2	3	0	0	3
19ECX35	Soft Computing	I,II,III	1,2,3,4,5,12	1,2	3	0	0	3
MANDATORY COURSE								
19MC201	Environmental Science and Engineering	I,IV	1,2,3,4,5,6,7, 8,12	-	3	0	0	0
19MC301	Indian Constitution	I,IV	6,8,9	3	2	0	0	0
OPEN ELECTIVES OFFERED TO OTHER DEPARTMENT STUDENTS								
19ECY01	VLSI Design	I,II,III	1,2,9,12	1,2	3	0	0	3
19ECY02	Communication Engineering	I,II,III	1,2,9,12	1,2	3	0	0	3
19ECY03	PCB Design	I,II,III	1,2,9,12	1,2	3	0	0	3

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Dept.of ECE - ESEC

19ECY04	Automotive Electronics	I,II,III	1,2,9,12	1,2	3	0	0	3
19ECY05	Electronic Material	I,II,III	1,2,9,12	1,2	3	0	0	3
19ECY06	Bio medical Instrumentation	I,II,III	1,2,9,12	1,2	3	0	0	3
19ECY07	Sensors for Engineering Applications	I,II,III	1,2,9,12	1,2	3	0	0	3
19ECY08	Principles of Digital Image Processing	I,II,III	1,2,9,12	1,2	3	0	0	3
19ECY09	Discrete time Signal Processing	I,II,III	1,2,9,12	1,2	3	0	0	3
19ECY10	Information and Coding Theory	I,II,III	1,2,9,12	1,2	3	0	0	3
ADDITIONAL ONE CREDIT COURSE								
19ECZ01	Simulation Technologies for Real Time Communication Networks	I,II,III	1,3,6,9, 10,11	-	1	0	0	1
19ECZ02	Hands on Course in Embedded Systems	I,II,III	1,2,3,4,5, 9,11,12	-	1	0	0	1
19ECZ03	Internet of Things (IoT) using CC3200	I,II,III	1,2,3,4,5, 9,11,12	-	1	0	0	1
19ECZ04	Advanced Motor Control Applications Using 32 Bit Real time Controllers	I,II,III	1,2,3,4,5, 9,11,12	-	1	0	0	1
19ECZ05	Advanced System Design Using 16 Bit Ultra Low power Microcontrollers	I,II,III	1,2,3,4,5, 9,11,12	-	1	0	0	1
19ECZ06	Advanced Analog System Design	I,II,III	1,2,3,4,5, 9,11,12	-	1	0	0	1
19ECZ07	Hands on Course in PCB Designing using Protel (Altium Designer), PADS tool	I,II,III	1,2,3,4,5, 9,11,12	-	1	0	0	1
19ECZ08	Foundation Course in Community Radio Technology	I,II,III	1,2,3,4,5, 9,11,12	-	1	0	0	1
19ECZ09	LTE and the Evolution to 4G Wireless Communication	I,II,III	1,6,7,9, 10,11,12	-	1	0	0	1
19ECZ10	Millimeter wave Communication Networks	I,II,III	1,6,7,9, 10,11,12	-	1	0	0	1
19ECZ11	Fiber Optic Cable Installation and OTDR Testing	I,II,III	1,2,3,4,5, 9,11,12	-	1	0	0	1
19ECZ12	RTOS and its Application	I,II,III	1,6,8,9, 11,12	-	1	0	0	1
19ECZ13	Telematics	I,II,III	1,6,8,9, 11,12	-	1	0	0	1
19ECZ14	Advanced Verification Methodologies	I,II,III	1,6,7,10, 11,12	-	1	0	0	1
19ECZ15	E-Commerce Security	I,II,III	1,2,3,4, 9,11,12	-	1	0	0	1

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19ECZ16	Routing Architecture and Design	I,II,III	1,6,7,9, 10,11,12	-	1	0	0	1
19ECZ17	Embedded Protocols	I,II,III	1,6,7,9, 10,11,12	-	1	0	0	1

S.No.	Category	Credits Per Semester								Total Credit	Credits in %	Range of Total Credits	
		I	II	III	IV	V	VI	VII	VIII			Min	Max
1	BS	12	4	4	7	--	--	--	--	27	17	10%	20%
2	ES	6	8	4	4	--	--	--	--	22	14	10%	20%
3	HS	3	3	--	--	3	--	--	--	9	6	5%	10%
4	PC	--	4	12	12	11	12	12	--	63	39	30%	40%
5	PE	--	--	--	--	3	3	9	6	21	13	10%	15%
6	OE	--	--	--	--	3	3	-	-	6	3	5%	10%
7	EEC	1.5	1.5	--	-	2	-	1	6	12	8	10%	15%
Total		22.5	20.5	20	23	22	18	22	12	160	100	--	--

BS- Basic Science **ES**-Engineering Science **HS**-Humanities and Social Science
PE- Professional Elective **OE**- Open Elective **PC**- Professional Core
MC – Mandatory Course **CA** – Continuous Assessment
ES- End Semester Examination **EEC**-Employability Enhancement Course

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SEMESTER-I

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester- I	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS101	CALCULUS AND ITS APPLICATIONS	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is to

- Interpret the introductory concepts of Limit and continuity
- Interpret the introductory concepts of calculus, this will enable them to model and analyze physical phenomena involving continuous change of variables
- Find Eigen values and Eigen vectors which is one of the powerful tools to handle practical problems arising in the field of engineering.
- Summarize and apply the methodologies involved in solving problems related to functions of several variables.
- Develop enough confidence to identify surface and area there by solving using integration

Course Outcomes: At the end of this course, learners will be able to:

- Apply differentiation to solve maxima and minima problems use both the limit definition and rules of differentiation to differentiate functions
- Identify and model the real time problems using first order linear differential equations. Recognize and solve the higher order ordinary differential equations.
- Analyze the characteristics of a linear system with Eigen values and Eigen vectors.
- Characterize the functions of several variables and get the solutions of the same.
- Integrate the functions for evaluating the surface area and volume.

Unit I	LIMITS AND CONTINUITY	12
Representation of a function-Limit of a function-Continuity-Derivatives-Differentiation rules-Maxima and Minima of one variable		
Unit II	**ORDINARY DIFFERENTIAL EQUATIONS**	**12**
Linear differential equations of second and higher order with constant coefficients. Linear differential equations of higher order with variable coefficients: Cauchy's linear differential equation - Method of variation of parameters for second order differential equations-Vibrating string-Electrical circuits		
Unit III	**EIGEN VALUES AND EIGEN VECTORS**	**12**
Eigen Values and Eigen Vectors of a real matrix - Properties of Eigen Values - Cayley - Hamilton Theorem Orthogonal matrix- Diagonalisation-Quadratic form: Reduction of a quadratic form to a canonical form.		
Unit IV	**MULTIVARIABLE CALCULUS**	**12**
Functions of Two Variables and their solutions- Total Differential - Derivative of implicit functions-Jacobian's, Unconstrained maxima and minima.		
Unit V	**MULTIPLE INTEGRALS**	**12**
Double integration with constant and variable limits-Region of integration -Change the order of integration - Area as double integral in cartesian coordinates. Triple integral in Cartesian coordinates.		

Text Books(S):

1. Thomas Calculus, 14th Edition by Pearson
2. Erwin Kreyszig, Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited, New Delhi 2015.
3. Peter V. O Neil , Advanced Engineering Mathematics, Seventh Edition , Cengage Learning India Private Limited, 2012
4. C. Ray Wylie and C Louis Barrett, Advanced Engineering Mathematics, Sixth Edition, Tata McGraw-Hill Publishing Company Ltd, 2003.
5. Glyn James, Advanced Engineering Mathematics, Fourth Edition, Wiley India, 2015.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester- I	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS102	ENGINEERING PHYSICS	2	0	2	3	60	100	

Course Objective (s): The purpose of learning this course is to

- Enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology
- Get the basic knowledge on the properties of matters
- Acquire knowledge in Ultrasonics, Laser and fibers
- Enhance the knowledge in quantum theory
- Understand basic concepts of thermal properties of materials

Course Outcomes: At the end of this course, learners will be able to:

- Gain knowledge on the basics of properties of matter and its applications
- Acquire knowledge on the concepts of Ultrasonics and their applications
- Have adequate knowledge on the concepts of fiber & Laser and their applications
- Get knowledge on advanced Physics concepts of quantum theory and its applications in tunneling microscopes.
- Understand knowledge on the concepts of thermal properties of materials and their applications in expansion of joints and heat exchangers

Unit I	PROPERTIES OF MATTER	6

Elasticity – Stress-strain diagram and its uses - torsional stress and deformations – twisting couple - torsion pendulum: theory and experiment - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders.

Unit II	ULTRASONICS	6

Introduction–Classification of Sound- Ultrasonics Production - Magnetostriction generator - Piezo electric generator-cavitations-ultrasonic cleaning-Non Destructive Testing- Pulse echo system through transmission and reflection modes- A, B and C – scan displays- Engineering Applications-Cutting, welding and drilling.

Unit III	LASER AND FIBRE OPTICS	6

Lasers: population of energy levels, Einstein's A and B coefficients derivation – Semiconductor lasers: homojunction and heterojunction – Industrial applications of laser. Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, mode) – fibre optic sensors: pressure and displacement.

Unit IV	QUANTUM PHYSICS	6

Black body radiation – Planck's theory (derivation) – Compton effect: theory and experimental verification – wave particle duality – electron diffraction – concept of wave function and its physical significance – Schrödinger's wave equation – time independent and time dependent equations – particle in a one-dimensional rigid box.

Unit V	THERMAL PHYSICS	6

Transfer of heat energy – thermal expansion of solids and liquids – expansion joints - bimetallic strips - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – applications: heat exchangers, ovens and solar water heaters.

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TEXT BOOK(S):	
1.	Bhattacharya, D.K. & Poonam, T. —Engineering Physics□. Oxford University Press, 2015
2.	Gaur, R.K. & Gupta, S.L. —Engineering Physics□. Dhanpat Rai Publishers, 2012
3	Pandey, B.K. & Chaturvedi, S. —Engineering Physics□. Cengage Learning India, 2012

REFERENCE(S):	
1.	Halliday, D., Resnick, R. & Walker, J. —Principles of Physics. Wiley, 2020
2.	Serway, R.A. & Jewett, J.W. —Physics for Scientists and Engineers. Cengage Learning, 2019
3.	Tipler, P.A. & Mosca, G. - Physics for Scientists and Engineers with Modern Physics'. W.H.Freeman, 2007

Total: 30 hours

Exp No.	Name of Experiments (Any Five)
1	Determination of Rigidity Modulus – Torsion Pendulum
2	Determination of Young's Modulus by Non-Uniform Bending Method
3	(a) Determination of Wavelength, and Particle Size using Laser (b) Determination of Acceptance Angle in an Optical Fiber.
4	Determination of Thermal Conductivity of a Bad Conductor – Lee's Disc Method.
5	Determination of Velocity of Sound and Compressibility of Liquid – Ultrasonic Interferometer
6	Determination of Wavelength of Mercury Spectrum – Spectrometer Grating
7	Determination of Band gap of a Semiconductor
8	Determination of Thickness of a thin wire – Air Wedge Method

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-I	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS103	ENGINEERING CHEMISTRY	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the basic concepts of water characterization and treatment methods.
- Know the fundamental concepts of Electrochemistry and corrosion.
- Understand the principles and generation of energy in Batteries, Solar cells & Nuclear reactors.
- Gain knowledge on polymers
- Know the types of fuels and the manufacture of solid, liquid and gaseous fuels.

Course Outcomes: At the end of this course, learners will be able to

- Make the students conversant with water treatment techniques
- Know the reaction involved in corrosion and corrosion protection methods
- Impart knowledge on renewable energy sources like nuclear, solar and wind and to impart knowledge on energy storage devices.
- Aware the synthesis & industrial application of polymers
- Impart knowledge on different types of fuels (solid liquid, gas, primary, secondary and synthetic) and combustion process.

Unit I	WATER CHEMISTRY	9

Hardness of water – types – Estimation of hardness of water by EDTA method– – Domestic water treatment- boiler troubles (scales,sludge,priming,foaming,caustic embrittlememt) – Internal conditioning (carbonate,phosphate, sodium aluminate and calgon) .External treatment – Demineralization process – Reverse Osmosis.

Unit II	ELECTROCHEMISTRY AND CORROSION	9

Electrochemical cell - redox reaction, electrode potential- Nernst equation (derivation and problems). Electro Chemical series-Standard hydrogen electrode-Calomel Electrode. Corrosion: chemical & electrochemical corrosion (galvanic, differential aeration) - types-factors influencing corrosion rate corrosion control - sacrificial anode and impressed current cathodic protection method.

Unit III	ENERGY SOURCES	9

Introduction- nuclear energy- nuclear fission- nuclear fusion- nuclear chain reactions- light water reactor- breeder reactor. Batteries and fuel cells:Types of batteries- alkaline battery- lead storage battery- lithium ion battery.Fuel cell :H_2 -O_2 fuel cell.

Unit IV	POLYMER CHEMISTRY	9

Monomers - polymers - polymerization - functionality - degree of polymerization - classification of polymers based on source and applications. Types of polymerization: addition, condensation and copolymerization. Preparation, properties and applications of thermosetting (epoxy resin and bakelite) and thermoplastics (poly vinyl chloride, poly tetrafluoroethylene and PMMA). Rubber: SBR. Compounding of plastics (blow moulding, injection, extrusion) .

Unit V	FUELS AND COMBUSTION	9

Fuel: Introduction- classification of fuels- solid fuels-coal- proximate and ultimate analysis- manufacture of metallurgical coke (Otto Hoffmann method) – Liquid fuels: Refining of petroleum- synthetic petrol Fischer-Trophs and Bergius processes- knocking- octane number- cetane number – Gaseous fuels: liquefied petroleum gases(LPG)- water gas- bio diesel. Combustion- flue gas analysis (ORSAT Method).

TEXT BOOK(S):

1. Jain P.C. and Monica Jain, Engineering Chemistry, Dhanpat Rai Publishing Company (P) Ltd., New Delhi, 2019
2. Ravikrishnan A., Engineering Chemistry, Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2019

Chairman - BoS
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REFERENCE(S):	
1.	Dara S.S, Umare S.S, Engineering Chemistry, S. Chand & Company Ltd., New Delhi 2016
2.	Sivasankar B., Engineering Chemistry, Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2017.
3.	GowarikerV.R,Viswanatha.N.V,Jayadev Sreedhar-Polymer Science, Publishing company New Age International Publishers, New Delhi,2015.
4.	Ozin G. A. and Arsenault A. C., Nano chemistry: A Chemical Approach to Nano materials, RSC Publishing, 2017.
5.	Ashima Srivastava and Janhavi N N., Concepts of Engineering Chemistry, ACME Learning Private Limited., New Delhi. 2015.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester- I	ES
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES101	PYTHON PROGRAMMING	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Understand problem solving concepts.
- Understand why Python is a useful scripting language for developers and to read and write simple Python programs.
- Develop Python programs with conditionals and loops
- Use Python data structures lists, tuples, dictionaries.
- Do input/output with files in Python

Course Outcomes: At the end of this course, learners will be able to

- Apply problems solving techniques to real world problems.
- Recognize and construct common programming idioms: variables, loop, branch, and input/output.
- Design, code, and test Python programs using List, Tuples and Strings
- Write code using dictionaries and functions
- Read and write data from/to files in Python Programs.

Unit I	COMPUTATIONAL THINKING	9

Introduction to Computational Thinking –From abacus to machine – The first Software –First Modern Computer-Information and data - Converting information into data -Data Capacity Problem Solving Techniques: General problem Solving concepts-: Algorithm, Pseudo-code and Flowchart Problem Solving with Sequential Logic Structure - Problem Solving with Decisions - Problem Solving with Loops Case Study: Raptor and Scratch Tools.

Unit II	INTRODUCTION TO PYTHON	9

History- Features - Setting up path - Working with Python - Basic Syntax - Variable and Data Types - Operator - Conditional Statements – Looping – Control Statements

Unit III	STRING MANIPULATION, LIST AND TUPLES	9

Creating String - Accessing Strings - Basic Operations - String slices - Function and Methods – Creating List - Accessing list - Operations on List - Working with lists - Function and Methods – Creating tuple - Tuple Operations – Functions and Methods

Unit IV	DICTIONARIES AND FUNCTIONS	9

Creating Dictionaries - Accessing values in dictionaries - Working with dictionaries - Properties – Functions - Defining a function - Calling a function - Types of functions - Function Arguments - Anonymous functions - Global and local variables

Unit V	MODULES, FILES AND EXCEPTION HANDLING	9

Modules - Importing module - Math module - Random module - Packages - Composition Files - Opening and closing File- File Opening Modes - Reading and writing files – Functions Exception Handling - Exception - Exception Handling - Except clause - Try , finally clause User Defined Exceptions.

TEXT BOOK(S)

1. David Riley and Kenny Hunt, Computational Thinking for the Modern Problem Solver, Chapman &
2. Michael Dawson Python Programming for the Absolute Beginner, 3rd Edition, 2010.

REFERENCE(S)

1. M. Sprankle, Problem Solving and Programming Concepts, 9th Edition, Pearson Education, New
2. Brian Heinold, Introduction to Programming Using Python, Mount St. Mary's University, 2013.
3. Allen Downey, Green Tea Press Needham, Think Python, How to Think Like a Computer Scientist,
4. Cunningham, sams teach yourself python in 24 hours, Second edition Pearson, 2014

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester- I	HS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19HS101	COMMUNICATIVE ENGLISH	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Acquire basic English grammar.
- Develop listening skills to listen lectures and basic videos.
- Enhance the reading skill to comprehend technical writings.
- Improve writing skills to express thoughts freely.
- Develop speaking skills to speak fluently in real contexts.

Course Outcomes: At the end of this course, learners will be able to

- Improve language usage in LSRW skills.
- Develop listening skills to comprehend general / technical talks.
- Acquire the ability to understand different written texts.
- Enhance the writing skills to express the ideas of the learners.
- Communicate fluently in real time context.

Unit I	LANGUAGE FOCUS	9

Parts of speech - Word formation - Sentence types (declarative, imperative, exclamatory & interrogative) - Tense forms - Subject - Verb agreement

Unit II	LISTENING	9

Listening for specific information: Short conversations / monologues - Gap filling - Telephone conversations - Telephone etiquette - Note-taking - Listening for gist / interviews - Listening to songs and completing the lyrics - Clear individual sounds - Word stress

Unit III	READING	9

Completing the sentences - Prediction - Skimming for gist - Scanning for specific information - Understanding text and sentence structure - Close reading

Unit IV	WRITING	9

Paragraph writing (descriptive, narrative, expository & persuasive) - Letter (formal and informal) - Dialogue writing - E-mail - Instructions

Unit V	SPEAKING	9

Self-introduction - Giving personal and factual information - Talking about present circumstances, past experiences and future plans - Mini-presentation - Expressing opinions and justifying opinions - Agreement / disagreement - Likes and dislikes

TEXT BOOK(S)

1. Communicative English by KN Shoba ,Lourdes Joavani Rayen Publised by Cambridge university

REFERENCE(S)

1. Murphy, Raymond. English Grammar in Use – A Self-Study Reference and Practice Book For Intermedia
2. Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.
3. Anderson, Kenneth et al. Study Speaking: A Course in Spoken English for Academic Purposes. United Kingdom: Cambridge University Press 1992.
4. Wren and Martin, High school English Grammar and Composition, Publisher: S.Chand. 2019.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester I	EEC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19TPS01	SOFT SKILLS - I	1	0	1	1.5	30	100	

Course Objective (s): The purpose of learning this course is

- To develop basic grammar knowledge in English.
- To enhance Speaking Skills in English
- To improve Verbal and Non-verbal Communication Skills
- To develop Confidence and Emotional Intelligence
- To develop Inter Personal Skills.

Course Outcomes: At the end of this course, learners will be able to:

- Have competent knowledge of grammar
- Speak fluent English by enriching Vocabulary Knowledge.
- Have good Presentation Skills through verbal and non verbal communication.
- Handle any Situation with confidence by being emotionally stable.
- Work in a team by having team coherence and dealing with people.

Unit 1	**Effective English – Written English**	6

Basic rules of Grammar - Parts of Speech – Tenses – Verbs.Sentence Construction.Dialogues and Conversations – Writing. Exercises to practice and improve these skills.

Unit 2	**Effective English – Spoken English**	6

Vocabulary – Idioms & Phrases – Synonyms – Antonyms.Dialogues and Conversations –Writing. Exercises to practice and improve these skills.

Unit 3	**Art of Communication & The Hidden Data Involved**	6

Verbal Communication - Effective Communication - Active listening –Paraphrasing – Feedback.
Non Verbal Communication - Body Language of self and others.
Importance of feelings in communication - dealing with feelings in communication.

Unit 4	**World of Teams – Part -01**	6

Self Enhancement - importance of developing assertive skills- developing self confidence – developing emotional intelligence.

Unit 5	**World of Teams – Part -02**	6

Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved Working with Groups – Dealing with People- Group Decision Making.

REFERENCES:

1. The Seven Habits of Highly Effective People - Stephen R. Covey.
2. All the books in the "Chicken Soup for the Soul" series.
3. Man's search for meaning – Viktor Frankl
4. The greatest miracle in the world – Og Mandino
5. Goal - Eliyahu Goldratt.
6. Working with Emotional Intelligence - David Goleman.
7. Excel in English – Sundra Samuel, Samuel Publications
8. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi
9. Essentials of Effective Communication, Ludlow and Panthon; Prentice Hall of India.
10. Effective Presentation Skills (A Fifty-Minute Series Book) by Steve Mandel
11. "Strategic interviewing" by Richaurd Camp, Mary E. Vielhaber and Jack L. Simonetti – Published by Wiley India Pvt. Ltd
12. "Effective Group Discussion: Theory and Practice" by Gloria J. Galanes, Katherine Adams , John K. Brilhart

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-I	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
19BS105	CHEMISTRY LABORATORY	L	T	P	C			
		0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Determination of total, temporary & permanent hardness of water by EDTA method.
- Determination of chloride content of water sample by argentometric method.
- Estimation of iron content of the given solution using potentiometer.
- Determination of strength of given hydrochloric acid using pH meter.
- Conductometric titration of strong acid vs strong base.

Course Outcomes: At the end of this course, learners will be able to:

- Make the student to acquire practical skills in the determination of water quality parameters through Volumetric analysis.
- Acquire the knowledge about chloride content in water sample.
- Make the student to acquire practical skills about strength of iron using potentiometric titrations.
- Understand the how to estimate hydrochloric acid in water sample using pH meter.
- Gain the knowledge about conductance of ions

Exp No.	Name of Experiments (Any Ten)
1	Determination of Total, Temporary & Permanent hardness of water by EDTA method.
2	Determination of chloride content of water sample by Argentometric method.
3	Determination of Dissolved oxygen content in water sample using Winklers Method
4	Determination of Alkalinity in Water Sample
5	Determination of strength of given hydrochloric acid using pH meter.
6	Determination of strength of acids in a mixture of acids using conductivity meter.
7	Conductometric titration of Weak acid vs Weak base.
8	Estimation of iron content of the given solution using potentiometer.
9	Conductometric titration of strong acid vs strong base.
10	Determination of Molecular weight of polyvinyl alcohol using Ostwald viscometer
11	Estimation of iron content of the water sample using spectrophotometer
12	Estimation of Copper in Brass

LIST OF EQUIPMENTS

S.No	Description of Equipment	Quantity required	Quantity available
01	Potentiometer	10 Nos.	10 Nos.
02	pH meter	10 Nos.	10 Nos.
03	Conductivity meter	10 Nos.	10 Nos.
04	Spectrophotometer	2 Nos.	2 Nos.
05	Oswald viscometer	30 Nos.	30 Nos.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-I	ES
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES104	PYTHON PROGRAMMING LABORATORY	0	0	2	1	30	100	

Course Objective (s): The purpose of learning this course is to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples and dictionaries.
- Read and write data from/to files in Python.

Course Outcomes: At the end of this course, learners will be able to

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

List of Experiments:

1. Find the Greatest among three numbers without using third variable
2. Sum of the Digits of a Number
3. Generation of Prime Numbers
4. Implement a sequential search
5. Create a calculator program
6. Explore string functions
7. Implement Selection Sort
8. Implement Stack
9. Read and write into a file
10. Demonstrate usage of basic regular expression
11. Demonstrate use of advanced regular expressions for data validation.
12. Demonstrate use of List
13. Demonstrate use of Dictionaries
14. Create Comma Separate Files (CSV), Load CSV files into internal Data Structure

List of Equipment:

Software : Linux/Windows Python 2.7 and above Version , Hardware: 30 PCs

TEXT BOOK(S)

1. David Riley and Kenny Hunt, Computational Thinking for the Modern Problem Solver, Chapman & Hall/CRC, 2014.
2. Michael Dawson,Python Programming for the Absolute Beginner , 3rd Edition, 2010.

REFERENCE(S)

1. M. Sprankle, Problem Solving and Programming Concepts, 9th Edition, Pearson Education, New Delhi, 2011.
2. Brian Heinold, Introduction to Programming Using Python,Mount St. Mary's University, 2013.
3. Allen Downey, Green Tea Press Needham, Think Python, How to Think Like a Computer Scientist, Massachusetts.
4. Cunningham, sams teach yourself python in 24 hours, Second edition Pearson, 2014

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester- I	ES
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES106	ENGINEERING GRAPHICS	0	0	4	2	60	100

Course Objective (s): The purpose of learning this course is to

- Learn conventions and use of drawing tools in making engineering drawings.
- Draw orthographic projection of points and lines.
- Draw the projection of planes and simple solids.
- Draw the section of solids and obtain the development of surfaces of given solids.
- Draw the isometric projection of the given solids.

Course Outcomes: At the end of this course, learners will be able to:

- Recognize the conventions and apply dimensioning concepts while drafting simple objects.
- Draw the orthographic projection of points and lines.
- Draw the projection of planes and simple solids.
- Draw the section of solid drawings and development of surfaces of given solids.
- Draw the isometric projection of the given objects.

CONCEPTS AND CONVENTIONS (Not for Examination)	1

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

Unit I	PLANE CURVES	12

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of triangle, square and circle – Drawing of tangents and normal to the above curves.

Unit II	PROJECTION OF POINTS AND LINES	11

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method.

Unit III	PROJECTION OF PLANES & SOLIDS	12

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes. Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

Unit IV	PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES	12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

Unit V	ISOMETRIC PROJECTIONS	12

Principles of isometric projection – isometric scale –Isometric projections of simple solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions.

TEXT BOOK(S):

1. Natrajan K.V., A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 2012.
2. Venugopal K. and Prabhu Raja V., Engineering Graphics, New Age International (P) Limited, 2008.

REFERENCE(S):

1. Bhatt N.D. and Panchal V.M., Engineering Drawing, Charotar Publishing House, 50th Edition, 2010.
2. Basant Agarwal and Agarwal C.M., Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
3. Gopalakrishna K.R., Engineering Drawing (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
4. N S Parthasarathy and Vela Murali,Engineering Graphics, Oxford University, Press, New Delhi, 2015.

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Dept.of ECE - ESEC

SEMESTER-II

Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-II	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19BS201	VECTOR CALCULUS AND COMPLEX VARIABLES	3	1	0	4	60	100

Course Objective (s): The purpose of learning this course is to

- Summarize and apply the methodologies involved in solving problems related to fundamental principles of Calculus viz: Vector, Vector Differentiation and Vector Integration.
- Implement the Complex Analysis, an elegant method in the study of heat flow, fluid dynamics and electrostatics.
- Develop enough confidence to identify and model mathematical patterns in real world and offer appropriate solutions, using the skills learned in their interactive and supporting environment.
- Understand the complex functions.
- Defining a complex function and solving through complex integration

Course Outcomes: At the end of this course, learners will be able to:

- Characterize the calculus of vectors.
- Apply the theoretical aspects of vector integral calculus in their core areas.
- Recognize the differentiation properties of complex functions.
- Identify the complex functions and their mapping in certain complex planes.
- Use the concepts of integration to complex functions in certain regions.

Unit I	DIFFERENTIATION OF VECTORS	12
Vector point function- Directional derivative - Gradient -Divergence -Curl - Solenoidal – Irrotational vector fields –Scalar potential		
Unit II	**INTEGRATION OF VECTORS**	**12**
Work done - Line Integral - Surface integral- Green's theorem in a plane- Stoke's Theorem- Gauss divergence theorem- Applications involving cubes and parallelepiped.		
Unit III	**ANALYTIC FUNCTIONS**	**12**
Analytic Functions- Necessary and Sufficient conditions of Analytic Function- Properties of Analytic function - Determination of Analytic Function using Milne Thompson method -Applications to the problems of Potential Flow.		
Unit IV	**MAPPING OF COMPLEX FUNCTIONS**	**12**
Conformal mapping- Application of transformation: translation, rotation, magnification and inversion of multi valued functions - Linear fractional Transformation (Bilinear transformation).		
Unit V	**COMPLEX INTEGRATION**	**12**
Cauchy's Fundamental Theorem - Cauchy's Integral Formula - Taylor's and Laurent's series-Classification of Singularities - Cauchy's Residue Theorem		

REFERENCE(S):

1.	C. Ray Wylie and C. Louis Barrett, Advanced Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd, 2003
2.	Erwin Kreyszig , Advanced Engineering Mathematics, Tenth Edition, Wiley India Private Limited, New Delhi 2015
3.	J. A. Brown and R. V. Churchill, Complex Variables and Applications , Sixth Edition, McGraw Hill, New Delhi, 1996
4	Peter V. O. Neil, Advanced Engineering Mathematics, Seventh Edition ,Cengage Learning India Private Limited, 2012
5	Glyn James, Advanced Engineering Mathematics, Third Edition,Wiley India,2007

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-II	ES
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES202	ADVANCED C PROGRAMMING	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Develop C Programs using basic programming constructs
- Develop C programs using arrays and strings
- Develop applications in C using functions , pointers and structures
- Do input/output and file handling in C
- Use Interrupts in C Programming

Course Outcomes: At the end of this course, learners will be able to:

- Develop C applications using Arrays and Strings.
- Develop C applications using Function and Pointers.
- Develop application using structure and union.
- Design a C application using Sequential and Random-access file
- Develop program using Interrupts& bit level operations

Unit I	CONSTRUCTS OF C	9

Lexical elements – Operators - data types – I/O statements – format specifications – control statements – decision making and looping

Unit II	ARRAYS & FUNCTIONS	9

Array handling in C – declaration – single dimensional arrays, two – dimensional arrays, multidimensional arrays, sorting and searching on single and two dimensional arrays. Array order reversal, array counting or histogramming, finding the maximum number in a set, removal of duplicates from an ordered array, partition an array, finding the kth-smallest element strings: Character array – string handling functions – manipulation on strings. Prototype –declaration - arguments (formal and actual) – return types – types of functions difference between built-in and user-defined functions.

Unit III	POINTERS & STRUCTURES	9

Introduction to Pointers – Pointer Arithmetic – Pointer and Arrays – Returning Pointers. Declarations - nested structures- array of structures - structure to functions - unions- difference between structure and union – Command Line arguments

Unit IV	FILES AND HANDLING SIGNALS AND PROCESSES	9

File Introduction – File Modes – Reading and Writing Files – File related functions – Reading and Writing Binary Files – Random Access Files. What is process & Threads? Types of process and threads Use of fork, v fork? Daemon process, Signals and how to handle all signals. Use of return and exit statements

Unit V	INTERRUPT PROGRAMMING	9

Working with INT86 interrupts: Accessing Primary, Secondary Storage, Accessing Printers, Keyboards, Mouse and Monitors.

TEXT BOOK(S):

1. Brian W Kernighan, The C programming language, second edition Pearson Education Asia, 2005
2. E.Balagurusamy, C Programming, Second Edition, Tata Mcgraw Hill, 2009
3. Yaswant Kanitkar, Let Us C, 16th Edition, BPB Publication, 2015
4. Yaswant Kanitkar, Understanding Pointers in C, BPB Publication, 2015

REFERENCE(S):

1. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in C, First Edition, Oxford University Press, 2009.
2. Byron S. Gottfried, Schaum's Outline of Theory and Problems of Programming with C, McGraw-Hill Education, 1996.
3. Ivor Hortan, Instant C Programming, Wrox Press, 1995

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-II	ES
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ES205	ELECTRICAL ENGINEERING	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Discuss the characteristics and applications of various DC machines
- Study about the performance and testing of transformers
- Illustrate construction and principle of operation of AC machines
- Working principle of Various measuring instruments
- Study the various types of transducer and its application

Course Outcomes: At the end of this course, learners will be able to:

- Comprehend the concepts in various DC machines
- Realize the performance and testing of transformers
- Understand the construction and principle of operation of AC machines
- Choose appropriate measuring instruments for given application
- Understand the various types of transducer and its application

Unit I	DC MACHINES	12

Review of magnetic circuits: Faraday's laws of Electromagnetic Induction - Induced EMF - Direction of induced EMF and current - Statically and dynamically induced EMF – self and mutual inductance - Construction of DC machines – Theory of operation pf DC generators – Types – emf equation – characteristics of DC generators – operating principle of DC motors – Torque equation – Types of DC motors and characteristics – speed control of DC shunt and series motors – Applications.

Unit II	TRANSFORMER	8

Single phase transformer – Working principle and construction –Types - Core and Shell type –Applications – Ideal transformer- EMF equation of a transformer - Transformation ratio - Transformer on no load phasor diagram – Equivalent circuit of a transformer –Transformer losses and efficiency. .

Unit III	INDUCTION MACHINES AND SYNCHRONOUS MACHINES	12

Three-phase induction motors – Construction and types – Principle of operation - Slip- Single- phase induction motors – Construction and types – Starting methods of single phase induction motors- Alternator – Principle and Constructional details - Types –Synchronous motor – Principle of operation - Starting methods of synchronous motors – Synchronous capacitor -Applications.

Unit IV	MEASUREMENT CONCEPTS	7

Essentials of Measurement systems – Moving coil meters and Moving iron meters –Energymeter - Bridge measurements – Wheatstone, Maxwell, Schering and Wien - Digital Measurement of Electrical Quantities - Digital voltmeter - Electronic Multimeter

Unit V	TRANSDUCERS	6

Transducers –Types – Resistive: Strain gauge- thermocouple – thermistor, RTD – Capacitive - Piezo Electric– Inductive: LVDT, RVDT, MEMS Sensors – Nano sensors.

TEXT BOOK(S):

1. I.J Nagarath and Kothari DP, Electrical Machines, McGraw-Hill Education, 4th Edition, 2010.
2. Albert D. Helfrickand William D. Cooper Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, 2007.

REFERENCE(S):

1. Ernest O.Doeblin,Measurement Systems- Applications and Design, 5th Edition,McGraw Hill, 2007,New Delhi.
2. H.S.Kalsi, Electronic Measurement & Instrumentation, 2nd Edition, Tata McGraw Hill, 2004, New Delhi.
3. Thereja .B.L, Fundamentals of Electrical Engineering and Electronics, S Chand & Co Ltd, 2008.
4. J.B.Gupta,Theory and Performance of Electrical Machines,14th Edition,S.K.Kataria and Sons,2010,New Delhi.
5. John Bird, Electrical Circuit Theory and Technology, Elsevier, First Indian Edition, 2006.
6. A. K. Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai & Sons Publications, 2012, New Delhi.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-II	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES208	ANALOG ELECTRONICS - I	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Illustrate the construction and operation of semiconductor devices.
- Understand the methods of biasing PN diodes.
- Understand the methods of biasing transistors.
- Troubleshoot and fault analysis of power supplies.
- Classify the types and Operations of Voltage Regulators

Course Outcomes: At the end of this course, learners will be able to:

- Apply the concepts of semiconductor theory
- Comprehend the construction and characteristics of various electronic devices.
- Understand various special diodes.
- Design and analyze various power supply circuits
- Design simple application circuits using various electronic circuits

Unit I	SEMICONDUCTOR THEORY	9

Review of intrinsic and extrinsic semiconductors – Conductivity and mobility – Carrier concentration in intrinsic semiconductor – Mass Action Law - Fermi level – Charge densities in semiconductor - Drift and diffusion current.

Unit II	PN JUNCTION DIODE	9

Construction of PN junction diodes – VI characteristics – Quantitative theory of PN diode – Transition and diffusion capacitances – Applications: Voltage multipliers - Zener diode – Characteristics of Zener diode

Unit III	BJT , FET & MOSFET	9

Construction and principle of operation - I/O characteristics of BJT in CE, CB and CC configurations. JFET: Construction – Characteristics - MOSFET : Construction - Depletion and enhancement mode – Characteristics of MOSFET

Unit IV	SPECIAL DIODES	9

UJT -Tunnel diode –PIN diode – IGBT - SCR – TRIAC – DIAC – Photodiodes - LED, LCD - Photo transistors - Photo voltaic cell - Photo conductive cell

Unit V	RECTIFIERS AND POWER SUPPLIES	9

Full-wave: Centre tapped and bridge rectifiers with resistive load - Analysis for Vdc and ripple voltage with C, C-L, L-C and C-L-C filters. Zener diode regulator – Transistor voltage regulators: Series and shunt regulators – Line regulation - Output resistance - Temperature coefficient- Protection circuits - Switched mode power supply

TEXT BOOK(S):

1. Donald. A. Neamen, Electronic Circuits Analysis and Design, 3rd Edition, Mc Graw Hill Education (India) Private Ltd., 2010.
2. Salivahanan .S and Sureshkumar .N, Electronic Devices & Circuits, 4th Edition, Tata McGraw- Hill, New Delhi, 2016, ISBN : 9781259006418.
3. Albert Malvino, David J.Bates, Electronic Principles, 7th Edition, Tata McGraw- Hill, New Delhi, ISBN 978-0-07-337388-1

REFERENCE(S):

1. Millman J, Halkias.C.and Sathyabrada Jit, Electronic Devices and Circuits, 4th Edition, Mc Graw Hill Education (India) Private Ltd., 2015.
2. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits, 4th Edition, Mc Graw Hill Education (India) Private Ltd., 2017.
3. Floyd, Electronic Devices, Tenth Edition, Pearson Education, 2018.
4. David A. Bell, Electronic Devices & Circuits, 5th Edition, Oxford University Press, 2008.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-II	MC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19MC201	ENVIRONMENTAL SCIENCE AND ENGINEERING	3	0	0	0	45	100	

Course Objective (s): The purpose of learning this course is to

- Study the nature and facts about environment.
- Finding and implementing scientific, technological and economic solutions to environmental problems.
- Know the types of natural resources and the individual role in conserving the resources.
- Apply the knowledge to various social issues by understanding the environmental legislation laws.
- Study the integrated themes and biodiversity, natural resources, pollution control and waste management.

Course Outcomes: At the end of this course, learners will be able to:

- Extend their knowledge in maintaining ecological balance and make use of their knowledge in the preservation of biodiversity.
- Outline the role of human being in maintaining a clean environment and useful environment for the future generations.
- Explain the constituents of environment, precious resources in the environment and conservation of natural resources.
- Find the role of government and Non-Government organization and explain the various rain water harvesting techniques.
- Develop their awareness about population growth, Family planning programme and HIV/AIDS and extend their knowledge in role of informative technologies in IT and human health.

Unit I	ECOSYSTEMS AND BIODIVERSITY	10

Environment: Scope – importance - need for public awareness -Concepts of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Food chains- food webs - types of ecosystem - structure and functions of forest ecosystem and river ecosystem – Biodiversity - value of biodiversity - consumptive use-productive use - social - ethical - aesthetic values - Hotspots of biodiversity - Threats to biodiversity - Habitat loss - poaching of wildlife and man wildlife conflicts. Conservation of biodiversity - In-situ and Ex-situ conservation.

Unit II	ENVIRONMENTAL POLLUTION	8

Pollution: Causes - effects and control measures of Air pollution - Water pollution - Soil pollution and Noise pollution - Solid waste management - Causes - effects -control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster managements - Floods - cyclone- landslides.

Unit III	NATURAL RESOURCES	9

Forest resource - Use-over exploitation -deforestation - Water resource - use-over utilization of surface and ground water - conflicts over water - Mineral resource - use-exploitation-environmental effects of extracting and using mineral resource - Food resources - world food problems changes caused by agriculture - Effects of modern agriculture - fertilizer- pesticide problems - Energy resource - Renewable energy sources - solar energy - wind energy. Land resources - land degradation - soil erosion - Role of an individual in conservation of natural resources.

Unit IV	SOCIAL ISSUES AND THE ENVIRONMENT	9

Sustainable & Unsustainable development-Water conservation - rain water harvesting (roof top method)-climate change-global warming - acid rain - ozone layer depletion - Environment protection act - Air (Prevention and control of pollution) Act - Water (prevention and control of pollution) Act - Green Chemistry – 12 Principles of Green chemistry – Application of Green chemistry.

Unit V	HUMAN POPULATION AND THE ENVIRONMENT	9

Population growth - variation among nations - Population explosion & its consequences – Family,child, women welfare programmes - Human rights - HIV/AIDS – Human health and environment - Role of information technology in environment and human health.

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TEXT BOOK(S):	
1.	Anubha Kaushik and C.P. Kaushik, Environmental Science and Engineering, New Age International Publishers, New Delhi (2015)
2.	Dr. A.Ravikrishan, Envrionmental Science and Engineering., Sri Krishna Hitech Publishing co. Pvt. Ltd., Chennai,12th Edition (2016)

REFERENCE(S):	
1.	Masters, Gilbert M, Introduction to Environmental Engineering and Science, Second Edition, Pearson Education, New Delhi (2012).
2.	Santosh Kumar Garg, Rajeshwari garg, smf Ranjni Garg Ecological and Environmental Studies Khanna Publishers, Nai Sarak, Delhi (2014).
3.	R.K. Trivedi, Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standard, Vol. I and II, Enviro Media.
4.	Dharmendra S. Sengar, Environmental law, Prentice Hall of India PVT LTD, New Delhi, 2007. Rajagopalan, R, Environmental Studies-From Crisis to Cure, Oxford University Press 2005
5.	Cunningham, W.P. Cooper, T.H. Gorhani, Environmental Encyclopedia, Jaico Publ., House, Mumbai, 2015.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester II	EEC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19TPS02	SOFT SKILLS - II	1	0	1	1.5	30	100	

Course Objective (s): The purpose of learning this course is

- To train the Students on Group Discussion Do's and Don'ts.
- To coach the students on Interview Skills.
- To develop Presentation Skills.
- To develop Business Etiquette.
- To teach importance of Ethics and Values.

Course Outcomes: At the end of this course, learners will be able to:

- Participate Group Discussion with Confidence by knowing the tips and Tricks.
- Attend the interview with positive attitude by having Mock Interviews.
- Present them very well by enhancing their Presentation Skills.
- Behave very well in official gathering and Meeting by knowing Etiquette.
- Have good ethics and values in their Personal and Professional Life.

UNIT 1	GROUP DISCUSSION	6

GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do's & Don'ts – Mock GD & Feedback.

UNIT 2	INTERVIEW SKILLS	6

Interview handling Skills – Self preparation checklist – Grooming tips: do's & don'ts – mock interview & feedback.

UNIT 3	PRESENTATION SKILLS	6

Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback.

UNIT 4	Business Etiquette	6

Grooming etiquette – Telephone & E-mail etiquette – Dining etiquette – do's & Don'ts in a formal setting – how to impress.

UNIT 5	Ethics	6

Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news headlines.

REFERENCES:

1. The Seven Habits of Highly Effective People - Stephen R. Covey.
2. All the books in the "Chicken Soup for the Soul" series.
3. Man's search for meaning – Viktor Frankl
4. The greatest miracle in the world – Og Mandino
5. Goal - Eliyahu Goldratt.
6. Working with Emotional Intelligence - David Goleman.
7. Excel in English – Sundra Samuel, Samuel Publications
8. Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi.
9. Essentials of Effective Communication, Ludlow and Panthon; Prentice Hall of India.
10. Effective Presentation Skills (A Fifty-Minute Series Book) by Steve Mandel
11. "Strategic interviewing" by Richaurd Camp, Mary E. Vielhaber and Jack L. Simonetti – Published by Wiley India Pvt. Ltd
12. "Effective Group Discussion: Theory and Practice" by Gloria J. Galanes, Katherine Adams , John K. Brilhart

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-II	ES
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES214	ADVANCED C PROGRAMMING LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to

- Develop C Programs using basic programming constructs
- Develop C programs using arrays and strings
- Develop applications in C using functions , pointers and structures
- Do input/output and file handling in C
- Handle signals and Process and access peripherals

Course Outcomes: At the end of this course, learners will be able to

- Write a C Program using basic programming constructs.
- Develop C applications using Function and Pointers.
- Develop application using structure and union.
- Design a C application using Sequential and Random access file
- Develop a C program to interact with device

List of Experiments

1. Programs using only I/O Functions
2. Programs to study operators and data types
3. Programs based on control Structures
4. Programs using For and While loops
5. Programs using single dimensional arrays
6. Programs using multi Dimensional arrays
7. Programs on Sorting and searching using arrays
8. Programs based on string Manipulations
9. Programs based on User defined function programs
10. Programs using Functions with parameters
11. Program using storage classes
12. Programs to introduce pointers
13. Programs using structures
14. Programs using array of structures
15. Program to send and receive signals
16. Program to handle process
17. Program to display device details

List of Equipment:

- Standalone desktops with C++ Compiler - 30 Nos.
- Server with C++ compiler supporting 30 terminals or more.

TEXT BOOK(S)	
1.	Brian W Kernighan, The C programming language, second edition pearson Education Asia, 2005
2.	E.Balagurusamy, C Programming, Second Edition, Tata Mcgraw Hill, 2009
3.	Yaswant Kanitkar, Let Us C, 16th Edition, BPB Publication, 2015
4.	Yaswant Kanitkar, Understanding Pointers in C, BPB Publication, 2015
REFERENCE(S)	
1.	Paul Deitel and Harvey Deitel, —C How to Program, Seventh edition, Pearson Publication.
2.	Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in C, First Edition, Oxford University Press, 2009.
3.	Byron S. Gottfried, Schaum's Outline of Theory and Problems of Programming with C,McGraw -Hill Education, 1996.
4.	Ivor Hortan, Instant C Programming, Wrox Press, 1995

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Department	EECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-II	PC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
19ES219	DEVICES LABORATORY	L	T	P	C			
		0	0	2	1	30	100	

Course Objective (s): The purpose of learning this course is to

- Learn the characteristics of basic electronic devices such as Diode
- Understand the working of BJT,FET, SCR
- Gain hand on experience in simulation using PSPICE

Course Outcomes: At the end of this course, learners will be able to:

- Analyze the characteristics of basic electronic devices
- Interpret the characteristics of various electronic devices
- Perform simulation using PSPICE

Exp No.	Name of Experiments
1	Characteristics of PN Junction Diode
2	Zener diode Characteristics & Regulator using Zener diode
3	Common Emitter input-output Characteristics
4	Common Base input-output Characteristics
5	Characteristics of FET
6	Characteristics of SCR
7	Characteristics of UJT
8	Characteristics of MOSFET
9	Characteristics of TRIAC
10	Simulation of Characteristics of PN Junction Diode and Zener diode using SPICE
11	Simulation of Characteristics of BJT (common emitter configuration) and determination of h parameters using SPICE
12	Simulation of Characteristics of JFET and MOSFET using SPICE
13	Simulation of Characteristics of SCR and UJT using SPICE

List of Equipment:

- BC 107, BC 148,2N2646,BFW10 - 25 each
- 1N4007, Zener diodes - 25 each
- Resistors, Capacitors, Inductors - sufficient quantities
- Bread Boards - 15 Nos
- CRO (30MHz) – 10 Nos.
- Function Generators (3MHz) – 10 Nos.
- Dual Regulated Power Supplies (0 – 30V) – 10 Nos.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-III	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC301	ANALOG ELECTRONICS-II	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Learn the fundamental concepts behind transistor biasing and to differentiate small signal and large signal circuit models
- Understand the different Transistor configurations for BJT, FET.
- Study the performance metrics of Multistage and Power amplifiers.
- Understand the working of signal generating and wave shaping circuits
- Study about Oscillators and Multivibrator circuits.

Course Outcomes: At the end of this course, learners will be able to:

- Analyze parametric values for different biasing methods of BJT and FET.
- Design and model different Transistor configurations for Bipolar Junction Transistors and Field Effect Transistors using low frequency analysis.
- Analyze the behavior of Bipolar Junction Transistors and Field Effect Transistors at different frequency conditions.
- Design multistage and feedback amplifier circuits using Bipolar Junction Transistors and Field Effect Transistors.
- Design Oscillator and Multivibrator circuits using Bipolar Junction Transistors.

Unit I	SMALL SIGNAL LOW FREQUENCY MODELS	9

BJT: Analysis of transistor amplifier CE,CC&CB Configuration using h parameters , Simplified Hybrid Model for CB, CE & CC configurations, Comparison of transistor amplifier configurations, Darlington Pair. FET: Voltage Gain, Small Signal Equivalent Circuit model, Transconductance, T Equivalent Circuit Model.

Unit II	HIGH FREQUENCY MODELS	9

BJT: Behavior of Transistor at High Frequency, The High Frequency T Model, The Hybrid pi Common Emitter Transistor Model, - CB & CE Short Circuit Current Frequency response, Frequency Response of the CE Amplifier. FET: The Gate Capacitive effect, High Frequency MOSFET Model, Unity Gain Frequency, Frequency Response of CS Amplifier.

Unit III	MULTI STAGE AND FEEDBACK AMPLIFIERS	9

BJT: CE-CC Amplifier, Cascade Amplifier, RC coupled amplifier, Millers Theorem, High input resistance transistor circuits, Difference Amplifier- Step response and Frequency Response of Multistage Amplifiers.FET: MOS Difference Amplifier, Feedback amplifiers - Current Series, Voltage Shunt, Current shunt and Voltage Series.

Unit IV	SIGNAL GENERATORS AND WAVE SHAPING CIRCUITS	9

Basic Principles of Sinusoidal Oscillators, Classification of Oscillator- Barkhausen Criterion- RC Phase Shift ,Wien Bridge , General Form of LC- Hartley, Colpitts, Clapp Tuned Collector and Crystal Oscillators, Monostable, Astable and Bistable Multivibrators, RL and RC Circuits, Clippers & Clampers.

Unit V	TUNED AMPLIFIERS & POWER AMPLIFIERS	9

Small signal tuned amplifiers –Analysis of capacitor coupled single tuned amplifier – Double tuned amplifier - effect of cascading single tuned and double tuned amplifiers on bandwidth – Stagger tuned amplifiers. Power Amplifiers: Class A, Class B, Class C, Class AB and Class D Power Amplifiers, Distortion in Amplifier.

TEXT BOOK(S):

1. Sedra and Smith, Micro Electronic Circuits; Sixth Edition, Oxford University Press, 2011.
2. Jacob Millman, Microelectronics', McGraw Hill, 22nd, Reprint, 2009.

REFERENCE(S):

1. Robert L. Boylestad and Louis Nasheresky, Electronic Devices and Circuit Theory, 10th Edition, Pearson

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SEMESTER-III

Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-III	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19BS301	APPLIED LINEAR ALGEBRA	3	1	0	4	60	100

Course Objective (s): The purpose of learning this course is to

- Introduce the system of linear equations and solve numerically.
- Understand the concepts of vector space
- Understand linear transformations and Diagonalization.
- Apply the concept of inner product spaces in Orthogonalization.
- Apply Eigen values and Eigen vectors in real life

Course Outcomes: At the end of this course, learners will be able to:

- Explain the fundamental concepts of system of linear equations and their solutions
- Explain advanced algebra and their role in modern Mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques
- Demonstrate their mastery by solving non - trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
- Understand the applications of Eigen values and Eigen vectors

Unit I	SYSTEM OF LINEAR EQUATIONS	12

Direct method: Gauss elimination method – Gauss-Jordan method - Iterative methods: Gauss-Seidel method – LU decomposition method – Cholesky decomposition method - Relaxation Method.

Unit II	VECTOR SPACES	12

Vector spaces and subspaces – Linear independence and dependence – Basis and Dimension - Null spaces, column spaces – Dimension Theorem.

Unit III	LINEAR TRANSFORMATION	12

Similarity transformation – Diagonalization – Orthogonal space- matrix of linear transformation-Geometry of linear transformation-kernal-range- Nullity.

Unit IV	INNER PRODUCT SPACE	12

Inner product – Length and orthogonality – Orthogonal sets – Orthogonal projections – Inner product spaces – The Cauchy Schwarz Inequality - The Gram Schmidt Orthogonalization process - Applications of inner product spaces.

Unit V	APPLICATION OF EIGENVALUES AND EIGENVECTORS	12

Generalised eigen vectors-Power method – Jacobi method for symmetric matrix – Quadric surface.

Reference Book(S):

1. Strang, G., Linear Algebra and its applications, Thomson (Brooks/Cole), New Delhi, 2005
2. Friedberg, A.H., Insel, A.J. and Spence, L., Linear Algebra, Prentice - Hall of India, New Delhi, 2004.
3. Bernard Kolman, David R. Hill, Introductory Linear Algebra, Pearson Education, New Delhi, First Reprint 2009.
4. Howard Anton, Elementary Linear Algebra Applications , Wiley India Pvt. Ltd., Bangalore, 9th Edition, 2008.
5. Steven Chapra , Numerical Methods for Engineers , Tata McGraw Hill seventh Edition, 2015.

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	Education / PHI, 2008
2.	David A. Bell, Electronic Devices and Circuits, Fifth Edition, Oxford University Press, 2008.
3.	Millman J. and Taub H., Pulse Digital and Switching Waveforms, TMH, 2011.
4.	Millman and Halkias. C., Integrated Electronics, TMH, 2009.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-III	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EC302	DIGITAL ELECTRONICS	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Understand the concepts of Boolean expressions, Karnaugh map and Tabulation method for simplification
- Understand the concepts of combinational logic circuits for various applications
- Study about shift registers, Modulo-N asynchronous and synchronous counters
- Analyze and Design of state machines
- Elaborate different logic families.

Course Outcomes: At the end of this course, learners will be able to:

- Apply Boolean algebra, Karnaugh map and Tabulation method for simplification of Boolean expressions
- Design combinational logic circuits for various applications
- Design shift registers, Modulo-N asynchronous and synchronous counters
- Design and analyze state machines for the given specifications
- Discuss different logic families

Unit I	NUMBER SYSTEMS AND LOGIC GATES	9

Number System: Binary number system- Complements-Signed binary numbers- Binary arithmetic. Binary codes: Weighted and non-weighted codes: BCD – 2421 - Gray code – ASCII.
Logic Gates: Basic logic gates - Implementations of logic functions using basic gates and universal gates Comparison of TTL and CMOS characteristics.

Unit II	MINIMIZATION TECHNIQUES	9

Minimization Techniques: Boolean postulates and laws – De-Morgan's theorem - Principle of Duality - Boolean expression - Minimization of Boolean expressions – Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnaugh map minimization- Quine Mc Cluskey method of minimization

Unit III	COMBINATIONAL CIRCUITS	9

Combinational Circuits: Design procedure – Half adder and subtractor – Full adder and subtractor – Parallel binary adder and subtractor – Carry look ahead adder – BCD adder - Multiplexer/ Demultiplexer – Decoder - Encoder – Parity checker & generator – Code converters - Magnitude comparator.

Unit IV	SEQUENTIAL CIRCUITS	9

Sequential Circuits: Introduction, Flip flops –SR, JK, D and T –Level and Edge triggering - Realization of one flip flop using other flip flops- Design and analysis of synchronous sequential circuits: Characteristic and excitation tables and equations – State diagram, State table, State minimization and State assignment - Design of synchronous counters, ring counters and sequence detector – Registers: Shift registers- Universal shift register

Unit V	ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PLDS	9

Asynchronous Sequential Circuits: Analysis of asynchronous sequential circuits – Primitive state table / flow table – Minimization of primitive state table –State assignment – Excitation table - Cycles – Races – Hazards: Static –Dynamic –Essential –Hazards elimination. Implementation of combinational logic circuits using PLDs: PROM, PLA and PAL.

TEXT BOOK(S):

1. Morris Mano .M, Digital Design, 5th Edition, Pearson Education (Singapore) Pvt. Ltd., New Delhi.2018, ISBN : 9788131794654
2. Thomas L.Flyod, Digital Fundamentals, 11th Edition, Pearson Education (Singapore) Pvt. Ltd. 2017

REFERENCE(S):

1. John.M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2006, ISBN : 9788131500583
2. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2014. ISBN: 0070601755

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3.	Anand Kumar A., Fundamental of Digital Circuits, Prentice Hall of India Pvt. Ltd., 4th Edition, 2016
4.	Arivazhagan S Salivahanan, Digital Circuits And Design Vikas Publishing House Pvt Ltd, 4th Edition, 2012, ISBN: 9788125920632

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-III	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC303	SIGNALS AND SYSTEMS	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is to

- Understand the concepts of. different types of signals and Systems
- Comprehend the concepts of Fourier series, Fourier Transform and Laplace Transform
- Know about the Continuous Time systems
- Study the concepts of DTFT and Z Transform
- Understand Discrete Time systems with DTFT and Z Transform

Course Outcomes: At the end of this course, learners will be able to:

- Categorize Signals &Systems
- Analyze continuous time signals with Fourier series, Fourier Transform and Laplace Transform
- Analyze continuous time systems with Fourier Transform and Laplace Transform
- Analyze Discrete Time signals with DTFT and Z Transform
- Analyze Discrete Time systems with DTFT and Z Transform

Unit I	CLASSIFICATION OF SIGNALS AND SYSTEMS	12

Signals: Types of continuous and discrete time signals - Classification of CT and DT signals – Basic operations on signals. **Systems**: CT and DT systems- Classification and properties of systems.

Unit II	ANALYSIS OF CONTINUOUS TIME SIGNALS	12

Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and properties

Unit III	LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS	12

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

Unit IV	ANALYSIS OF DISCRETE TIME SIGNALS	12

Low Pass Sampling Theorem – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties

Unit V	LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS	12

Impulse response – Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

TEXT BOOK(S):

1. Oppenheim, Alanv., Willsky, Alan S, and Hamid Nawab S, Signals & Systems, 2nd Edition, Pearson Education, New Delhi, 2014, ISBN :9781292025902
2. Haykin, Simon and Barry Van Veen, Signals and Systems, John Wiley & Sons, 2nd Edition, NewYork, 2007, ISBN: 9788126512652

REFERENCE(S):

1. Roberts, M.J, Signals And Systems Analysis Using Transform Method and Matlab, 2nd Edition, Tata McGraw-Hill, New Delhi, ,2011, ISBN :9780073380681
2. Schaum's Outline of Signals and Systems, 3rd Edition ,2013

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Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-III	ES
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EC304	NETWORK THEORY	3	1	0	4	60	100

Course Objective (s): The purpose of learning this course is to

- Introduce the basic concepts of DC and AC circuits behavior and analysis
- Introduce different methods of circuit analysis using Network theorems, duality and topology
- Introduce the phenomenon of resonance and coupled circuits.
- Study the transient and steady state response of the circuits.
- Introduce the various analysis parameter of two port network

Course Outcomes: At the end of this course, learners will be able to:

- Develop the capacity to analyze of DC and AC circuits behavior and analysis
- Develop the capacity to apply the various network theorems to AC and DC circuits
- Design and understand the phenomenon of resonance and coupled circuits.
- Analyze the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- Analyze various parameter of two port network

Unit I	BASIC CIRCUITS ANALYSIS AND NETWORK TOPOLOGY	12

Ohm's Law – Kirchhoff's laws – Mesh current and node voltage method of analysis for D.C and A.C. circuits - Network terminology - Graph of a network - Incidence and reduced incidence matrices – Trees – Cutsets - Fundamental cutsets - Cutset matrix – Tie sets - Link currents and Tie set schedules -Twig voltages and Cutset schedules, Duality and dual networks.

Unit II	NETWORK THEOREMS FOR DC AND AC CIRCUITS	12

Network theorems -Superposition theorem, Thevenin's theorem, Norton's theorem, Reciprocity theorem, Millman's theorem, and Maximum power transfer theorem ,application of Network theorems- Network reduction: voltage and current division, source transformation – star delta conversion.

Unit III	RESONANCE AND COUPLED CIRCUITS	12

Resonance - Series resonance - Parallel resonance - Variation of impedance with frequency -Variation in current through and voltage across L and C with frequency – Bandwidth - Q factor -Selectivity. Self inductance - Mutual inductance - Dot rule - Coefficient of coupling - Analysis of multi winding coupled circuits - Series, Parallel connection of coupled inductors - Single tuned and double tuned coupled circuits.

Unit IV	TRANSIENT ANALYSIS	12

Natural response-Forced response - Transient response of RC, RL and RLC circuits to excitation by Step Signal, Impulse Signal and exponential sources - Complete response of RC, RL and RLC Circuits to sinusoidal excitation.

Unit V	TWO PORT NETWORKS	12

Two port networks, Z parameters, Y parameters, Transmission (ABCD) parameters, Hybrid (H) Parameters, Interconnection of two port networks, Symmetrical properties of T and π networks.

TEXT BOOK(S):

1. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, Engineering Circuit Analysis, McGraw Hill Science Engineering, Eighth Edition, 11th Reprint 2016.
2. Joseph Edminister and Mahmood Nahvi, Electric Circuits, Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

REFERENCE(S):

1. Charles K. Alexander, Mathew N.O. Sadiku, Fundamentals of Electric Circuits, Fifth Edition, McGraw Hill, 9th Reprint 2015.
2. A.Bruce Carlson, Cicuits: Engineering Concepts and Analysis of Linear Electric Circuits, Cengage Learning, India Edition 2nd Indian Reprint 2009.
3. Allan H.Robbins, Wilhelm C.Miller, Circuit Analysis Theory and Practice, Cengage Learning, Fifth Edition, 1st Indian Reprint 2013.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-III	MC
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19MC301	INDIAN CONSTITUTION	2	0	0	0	30	100

Course Objective (s): The purpose of learning this course is to

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- Address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: At the end of this course, learners will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

Unit I	**History of making of Indian Constitution**	**5**
History of Indian Constitution - Drafting Committee, (Composition & Working)		
Unit II	**Philosophy of the Indian Constitution**	**5**
Preamble - Salient Features		
Unit III	**CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES**	**5**
Fundamental Rights - Right to Equality - Right to Freedom - Right against Exploitation -Right to Freedom of Religion - Cultural and Educational Rights - Right to Constitutional Remedies - Directive Principles of State Policy - Fundamental Duties.		
Unit IV	**ORGANS OF GOVERNANCE**	**5**
Parliament - Composition - Qualifications and Disqualifications - Powers and Functions Executive - President - Governor - Council of Ministers - Judiciary, Appointment and Transfer of Judges, Qualifications - Powers and Functions.		
Unit V	**LOCAL ADMINISTRATION**	**5**
District's Administration head: Role and Importance, - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Pachayati raj: Introduction, PRI: ZilaPachayat - Elected officials and their roles, CEO Zila Pachayat: Position and role- Block level: Organizational Hierarchy (Different departments) -Village level: Role of Elected and Appointed officials - Importance of grass root democracy.		
Unit VI	**ELECTION COMMISSION**	**5**
Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women		

REFERENCE(S):

1.	"The Constitution of India", 1950 (Bare Act), Government Publication.
2.	Dr. S. N. Busi, "Dr. B. R. Ambedkar Framing of Indian Constitution", 1st Edition, 2016. Ava Publishers
3.	M. P. Jain, "Indian Constitution Law", 7th Edn., Lexis Nexis, 2014.
4.	D.D. Basu , Introduction to the Constitution of India, Lexis Nexis, 2015.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	III
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19TPS03	QUANTITATIVE APTITUDE AND LOGICAL REASONING - I	2	0	0	0	30	100	

Course Objective (s): The purpose of learning this course is to

- Crack aptitude assessment by using speed math concepts.
- Solve problems using fast track method by learning simplification and numbers.
- Learn the basic of ratio and proportion and mixture concepts.
- Calculate different ways of solving problems on average and ages.
- Learn the logical skills by analyzing the objects.

Course Outcomes: At the end of this course, learners will be able to:

- Solve the question with speed and accuracy.
- Crack the quantitative aptitude questions by using simplification and numbers system.
- Solve most of the aptitude topics by knowing ratio and proportion topics with allegation.
- Solve the problems on average and ages by using logical way of approach.
- Develop their logical thinking.

UNIT 1	SPEED MATHS AND NUMBER SYSTEMS	6

SPEED MATHS: Square and square roots – Square for numbers from 31 to 50. Finding squares of numbers between 81 to 100. Cubes and cubes roots.

NUMBER SYSTEMS: Numbers and types of Numbers – Properties of Numbers –Face value and place value - Divisibility rules – Concept on unit digit and remainder theorem.

UNIT 2	SIMPLIFICATIONS & PROBLEMS ON NUMBERS	6

SIMPLIFICATIONS: BODMAS rule – Application of algebraic formulae –Simplification of decimal fraction & mixed fraction – Continued fraction and its simplification – Recurring decimals.

PROBLEMS ON NUMBERS: Set of numbers – Assume the unknown numbers and form equations

UNIT 3	RATIO & PROPORTION ,ALLIGATIONS & MIXTURE	6

.RATIO AND PROPORTION: Ratio between two or more persons – Miscellaneous problems.

ALLIGATIONS ANS MIXTURES: Definition – Allegation rule – Mean value (or cost price) of the mixture – Six golden rules to solve problems on mixture – Removal among the quantities more than two.

UNIT 4	AVERAGES & PROBLEM ON AGES	6

AVERAGES: Average from total –Total from the average – Miscellaneous problems.

PROBLEMS ON AGES: Ages - Persons in Past - Present - Future. Miscellaneous problem.

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UNIT 5	ANALOGY & MIRROR & WATER IMAGES	6

ANALOGY: Study and topic relationship – Worker and tool relationship – Tool and action relationship – Work and working place – Worker and product – Product and raw materials – Instrument and measurement – Quantity and unit – Animals and young ones – Male and female.

MIRROR IMAGES AND WATER IMAGES: Letter inverted – Object inverted.

TOTAL : 30 HOURS

REFERENCES:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.
3. R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.
4. Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.
5. Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018.
6. "Reasoning and Aptitude" for GATE and ESE Prelims, Made Easy Publication,2020.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-III	PC
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EC305	ANALOG ELECTRONICS LABORATORY	0	0	2	1	30	100

Course Objective (s): The purpose of learning this course is to

- Study the characteristic of CE,CB and CC Amplifier
- Learn the frequency response of CS Amplifiers
- Study the Transfer characteristic of differential amplifier
- Perform experiment to obtain the bandwidth of single stage and multistage amplifiers
- Perform SPICE simulation of Electronic Circuits

Course Outcomes: At the end of this course, learners will be able to:

- Analyze the limitation in bandwidth of single stage and multi stage amplifier
- Simulate amplifiers using Spice
- Measure CMRR in differential amplifier.
- Analyze various types of feedback amplifiers
- Design oscillators, tuned amplifiers, wave-shaping circuits and multivibrators.

Exp No.	Name of Experiments
1	Frequency Response of CE and CS amplifiers
2	Darlington Amplifier
3	Differential Amplifiers - Transfer characteristics, CMRR Measurement
4	Cascode and Cascade amplifiers
5	Series and Shunt feedback amplifiers
6	RC Phase shift oscillator and Wien Bridge Oscillator
7	Single Tuned Amplifier
8	Astable and Monostable multivibrators using Spice
9	Schmitt Trigger circuit Using Spice
10	Analysis of Frequency Response of BJT and FET using Spice
11	Bistable Multivibrator using Spice

List of Equipment :

- CRO/DSO (30MHz) – 15 Nos.
- Signal Generator /Function Generators (3 MHz) – 15 Nos
- Dual Regulated Power Supplies (0 – 30V) – 15 Nos.
- Digital LCR Meter - 2 Nos
- Digital Multimeter - 15 Nos
- Standalone desktop PCs with SPICE software – 15 Nos.
- Transistor/FET (BJT-NPN-PNP and NMOS/PMOS) – 50 Nos
- SPICE Circuit Simulation Software: (any public domain or commercial software)
- Components and Accessories: Transistors, Resistors, Capacitors, Inductors, diodes, Zener Diodes, Bread Boards, Transformers. SPICE Circuit Simulation Software: (any public domain or commercial software)

Chairman - BoS
Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-III	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
19EC306	DIGITAL ELECTRONICS LABORATORY	L	T	P	C	30	100	
		0	0	2	1			

Course Objective (s): The purpose of learning this course is to

- Understand the fundamentals of logic gate and its use in implementing basics Boolean function.
- Gain knowledge on various types of combinational, sequential and digital logic circuits.
- Analyze sequential digital circuits like flip-flops, registers, counters.
- Understand the importance and need for verification, testing of digital logic and design for testability
- Remember various synchronous and asynchronous sequential circuits.

Course Outcomes: At the end of this course, learners will be able to:

- Learn the basics of gates.
- Construct basic combinational circuits and verify their functionalities
- Apply the design procedures to design a basic sequential circuits
- Learn about counters and shift registers
- Understand basic digital circuits and to verify their operation.

Exp No.	Name of Experiments
1.	Verification of Boolean theorems using digital logic gates.
2.	Design and implementation adder and Subtractor using logic gates
3.	Design and implementation of 4 bit binary Adder/ Subtractor using MSI devices.
4.	Design and implementation of code converters using logic gates (i) BCD to excess-3 code and vice versa (ii) Binary to gray and vice-versa
5.	Design and implementation of multiplexers and demultiplexers using basic gates and MSI devices
6.	Design and implementation of decoders and encoders using basic gates and MSI devices
7.	Implementation of Boolean Functions using MUX
8.	Design and implementation of simple ALU using basic gates and MSI devices
9.	Design and implementation of parity generator/checker using basic gates and MSI devices
10.	Design and implementation of magnitude comparator using basic gates and MSI devices
11.	Design of BCD to seven-segment display using 7447 IC
12.	Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters
13.	Design and implementation of shift registers in SISO, SIPO PISO, PIPO modes using ICs.
14.	Simulation of Experiments 1,2,3,4 using Modelsim

List of Equipment :

- Dual power supply/ single mode power supply - 15 Nos
- IC Trainer Kit - 15 Nos
- Bread Boards - 15 Nos
- Seven segment display -15 Nos
- Multimeter - 15 Nos
- ICs each 50 Nos 7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 / 74151 / 74147 / 7445 / 7476/7491/ 555 / 7494 / 7447 / 74180 / 7485 / 7473 / 74138 / 7411 / 7474

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Dept.of ECE - ESEC

SEMESTER-IV

Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-IV	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19BS404	PROBABILITY AND STOCHASTIC PROCESS	3	1	0	4	60	100

Course Objective (s): The purpose of learning this course is to

- Understand the basic concepts of probability and the distributions with characteristics.
- Study the concepts of two dimensional random variables.
- Understand the basic concepts of random processes which are widely used in IT fields.
- Understand the concept of correlation and spectral densities.
- Understand the significance of linear systems with random inputs.

Course Outcomes: At the end of this course, learners will be able to:

- Demonstrate and apply the basic probability axioms and concepts in their core areas. Apply the concepts of probability distributions in an appropriate place of science and Engineering.
- Calculate the relationship of two dimensional random variables using correlation techniques and to study the properties of two dimensional random variables.
- Apply the concept random processes in engineering disciplines.
- Understand and apply the concept of correlation and spectral densities.
- The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable. Able to analyze the response of random inputs to linear time invariant systems.

Unit I	PROBABILITY AND RANDOM VARIABLES	12

Probability – Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

Unit II	TWO - DIMENSIONAL RANDOM VARIABLES	12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

Unit III	RANDOM PROCESSES	12

Classification – Stationary process – Markov process - Markov chain - Ergodic Process - Poisson process – Random telegraph process.

Unit IV	CORRELATION AND SPECTRAL DENSITIES	12

Auto correlation functions – Cross correlation functions – Properties – Wiener Khinchin process- Power spectral density – Cross spectral density – Properties.

Unit V	LINEAR SYSTEMS WITH RANDOM INPUTS	12

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

Text Book(S):

1. Cooper. G.R., McGillem. C.D., Probabilistic Methods of Signal and System Analysis, Oxford University Press, New Delhi, 3rd Indian Edition, 2012.
2. Sheldon M.Ross Stochastic Processes Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2008.
3. Miller. S.L. and Childers. D.G., Probability and Random Processes with Applications to Signal Processing and Communications, Academic Press, 2004.

REFERENCE(S):

1. Stark. H. and Woods. J.W., Probability and Random Processes with Applications to Signal Processing, Pearson Education, Asia, 3rd Edition, 2002.
2. Yates. R.D. and Goodman. D.J., Probability and Stochastic Processes, Wiley India Pvt. Ltd., Bangalore, 2nd Edition, 2012.

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Dept. of Maths - ESEC

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-IV	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19BS407	ELECTROMAGNETICS AND WAVEGUIDES	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Study the basics of electrostatic
- Know about the various laws associated with magneto statics
- Understand Maxwell's equation and electromagnetic waves
- Study about the various types of guided wave
- Know about rectangular waveguides and resonator

Course Outcomes: At the end of this course, learners will be able to:

- Discuss the fundamental concepts of electrostatics
- Discuss the fundamental law of magneto statics
- Apply the Maxwell equations and wave equation
- Evaluate the characteristic s of guided waves
- Evaluate the characteristic s of Rectangular wave guides

Unit I	ELECTROSTATICS	9

Introduction to Coordinate system - Rectangular, cylindrical and spherical coordinate system - Coulomb's law - Electric field intensity - Electric field intensity of line charge, sheet charge - Electric flux density - Gauss law - Applications of Gauss law - Electric potential - Potential due to dipole - Poisson's and Laplace equation - Boundary conditions for electric field.

Unit II	MAGNETOSTATICS	9

Biot-Savart Law – Applications - Ampere's circuital law – Applications - Magnetic vector potential - Magnetic flux and Magnetic flux density - Nature of magnetic materials - Boundary conditions for Magnetic field.

Unit III	MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES	9

Faraday's law - Displacement current - Maxwell's equation in point form and integral form for steady and time varying fields - Poynting vector and Poynting theorem -Wave Equation - Uniform Plane Waves - Reflection and Refraction - Wave Polarization.

Unit IV	GUIDED WAVES	9

Waves between parallel planes of perfect conductors - Field Equations – TE waves - TM waves – Characteristics of TE and TM waves – TEM Waves – Velocities of propagation – Attenuation of TE and TM waves in parallel plane guides – Wave impedances.

Unit V	RECTANGULAR WAVEGUIDES AND RESONATORS: RECTANGULAR WAVEGUIDES	9

Field equations – TM waves – TE waves – Characteristic of TE and TM Waves: Cutoff wavelength and phase velocity – Impossibility of TEM waves– Dominant mode – Wave impedances – Characteristic impedance – Excitation of mode – Microwave cavity resonator - Rectangular cavity resonators - Q factor of a cavity resonator for TE101 mode.

TEXT BOOK(S):

1. William H.Hayt,Jr and John A.Buck, Engineering Electromagnetics, 7th Edition, Tata McGraw-Hill Publishing Ltd, 2011, ISBN : 9780070612235, 0070612234
2. E.C. Jordan & K.G. Balmain, Electromagnetic Waves and Radiating Systems, Prentice Hall of India, 2nd Edition 2011.
3. David K Cheng, Field and Wave Electromagnetics, Pearson Education Inc, Delhi, 2004

REFERENCE(S):

1. Ramo, Whinnery and Van Duzer, Fields and Waves in Communications Electronics, 3rd Edition, John Wiley & Sons , 2003, ISBN : 8129702606
2. Matthew N.O.Sadiku: Elements of Engineering Electromagnetics,4th Edition, Oxford University Press, 2007

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-IV	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC401	LINEAR INTEGRATED CIRCUITS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- Understand the characteristics and applications of operational amplifiers.
- Know about special function Operational Amplifier and its application
- Understand the operation of 555 families of ICs and characteristics of PLL
- Study the operation of D/A and A/D converter types and its characteristics
- Understand the operation of voltage regulator.

Course Outcomes: At the end of this course, learners will be able to:

- Describe the fundamentals and areas of applications for the integrated circuits.
- Develop and analyze special function Operational Amplifier and its application
- Describe the operation of 555 families of ICs and characteristics of PLL
- Discuss the operation of D/A and A/D converter types and its characteristics
- Explain the operation of voltage regulator.

Unit I	Introduction to Operational Amplifier	9

Basics of operational amplifier - Ideal and practical characteristics of Op-Amp – Block schematic of Operational amplifier - Differential amplifier – Transfer characteristics – Low frequency small signal analysis using h-parameters – Circuits for improving CMRR: Constant current sources, Widlar and Wilson current sources.

Unit II	Characteristics of Operational Amplifiers	9

DC Characteristics: Input bias current- Input offset current- Input offset voltage - Thermal drift – AC characteristics: Frequency response- Stability and slew rate – Frequency compensation methods.

Unit III	Applications of Operational Amplifier	9

Adder - Subtractor- Instrumentation amplifier – Differentiator – Integrator –V/I and I/V converter - Comparator- Signal generators: Astable and monostable multivibrator - Schmitt trigger- Sinewave generators: RC phase shift oscillator and Wien bridge oscillator- Triangular wave generator.

Unit IV	Operational Amplifier in Signal Conditioning Circuits	9

Active Filter: I and II order low pass and high pass filters – Switched capacitor filter - Analog to digital Converter: Flash type, Integrating type and successive approximation type- Digital to analog converter: Weighted resistor type, R-2R ladder type and inverted R-2R ladder type.

Unit V	Special ICs	9

Timer (IC 555): Functional block diagram - Astable and monostable operation – Applications. Voltage controlled oscillator (IC 566) – Phase locked loop (IC 565) - Functional block diagram, Application: AM, FM demodulators and Frequency synthesizers – Voltage regulator IC: Series op-amp regulator (78XX) – Switching regulator - Switching voltage regulator IC .

TEXT BOOK(S):

1. Gayakwad. A.R OP- AMPS and Linear Integrated Circuits, Fourth edition, Prentice Hall of India, New Delhi, 2003.
2. Roy Choudhury and Shail Jain Linear Integrated Circuits, Wiley Eastern, New Delhi, 2014

REFERENCE(S):

1. Sonde, B.S, Introduction to System Design using Integrated Circuits, Second Edition, Wiley Eastern Limited, New Delhi, 1994.
2. Michael Jacob .J,Analog Integrated Circuits and Applications, First edition, Prentice Hall of India, New Delhi, April 2000.
3. Robert F Coughlin and Fedrick F Driscoll Operational amplifiers and linear Integrated Circuits, Fifth edition, Prentice Hall of India, New Delhi, 2001.

Chairman - BoS
Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-IV	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC402	DIGITAL SIGNAL PROCESSING	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is to

- Study the principles of discrete-fourier transform
- Study about discrete time systems and to learn about FFT algorithms.
- understand the finite word length effects in signal processing
- Understand the effects of finite register length
- Program using DSP processors

Course Outcomes: At the end of this course, learners will be able to:

- Apply DFT algorithm for signal analysis
- Design of digital filter for the given specification
- Realize digital filter for the given specification
- Discuss finite word length effects
- Utilize DSP processor for real time applications.

Unit I	DISCRETE FOURIER TRANSFORM	12

Introduction to DFT and FFT: Review of DTFT, DFT - Properties of DTFT , DFT– FFT algorithms – Radix-2 FFT algorithms – Decimation in time – Decimation in frequency algorithms – Linear and circular convolution - Overlap add and save method.

Unit II	DESIGN OF DIGITAL IIR FILTERS	12

Characteristics of practical frequency selective filters. Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations

Unit III	DESIGN OF DIGITAL FIR FILTERS	12

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations

Unit IV	EFFECTS OF FINITE WORD LENGTH REGISTER	12

Quantization noise – Derivation for quantization noise power –Truncation and rounding error – Input quantization error-Coefficient quantization error-Product quantization error – Limit cycle oscillations-Overflow error-Signal scaling.

Unit V	PROGRAMMABLE DIGITAL SIGNAL PROCESSORS	12

Introduction to programmable DSPs –TMS320C67xx – Architecture of C67X – C67X buses – Memory organization- CPU – ALU – Barrel shifter – Multiplier / adder unit –Addressing modes– Instruction set – Application programs.

TEXT BOOK(S):

1. John G Proakis and Manolakis, Digital Signal Processing Principles, Algorithms and Applications, Pearson, Fourth Edition, 2014.
2. Lonnie C Ludeman, Fundamentals of Digital Signal Processing, Wiley India, New Delhi, 2010
3. Avtar Singh and Srinivasan S, Digital Signal Processing, Implementation using DSP Microprocessors with examples from TMS320C67XX, Thomson/Brooks/Cole, California, United States, 2010.

REFERENCE(S):

1. Oppenheim A V, Discrete Time Signal Processing, Prentice Hall India, New Delhi, 2010.
2. Sanjith K Misra, Digital Signal Processing: A Computer based Approach, 4th edition, India, 2013, Tata McGraw-Hill, ISBN 978-0-07-066756-3

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-IV	PC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC403	ANALOG COMMUNICATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Study Amplitude Modulation Systems
- Learn Angle Modulation Systems .
- Acquire knowledge about random process and Noise in Communication Systems
- Understand the influence of noise on the performance of analog communication systems.
- Study information theory and coding techniques.

Course Outcomes: At the end of this course, learners will be able to:

- Design Amplitude Modulation Systems
- Design Angle Modulation Systems.
- Analyse random process and Calculate noise in communication Systems
- Evaluate the performance of the communication system in the presence of noise.
- Determine Channel Capacity and Analyze coding techniques.

Unit I	AMPLITUDE MODULATION SYSTEMS	9

Need for modulation – Classifications of modulation techniques-Generation and detection: AM, DSBSC, SSB-SC, VSB-Comparison of Amplitude modulation systems- AM transmitters-AM receivers-Superheterodyne Receivers

Unit II	ANGLE MODULATION SYSTEMS	9

Frequency modulation: Narrowband and wideband FM- Phase Modulation- Generation of FM signal, Direct FM, indirect FM- Demodulation of FM signals -FM stereo multiplexing- FM transmitters- FM receivers.

Unit III	NOISES IN COMMUNICATION SYSTEMS	9

Random variable-Random process- strict sense stationary-wide sense stationary- Ergodic process-Gaussian process- Wiener–Khinchin theorem-Types of Noise - noise figure – noise temperature-Noise equivalent Bandwidth, Narrowband noise, Representation of Narrowband noise in terms of envelope and phase components, Sine wave plus Narrowband Noise .

Unit IV	NOISE PERFORMANCE OF AM AND FM RECEIVERS	9

Noise in AM receivers- Noise in DSB-SC receiver- Noise in SSB receiver- Noise in FM receivers- Capture and threshold effect- Pre-emphasis and de-emphasis in FM-Comparison of noise performance of AM and FM systems.

Unit V	INFORMATION THEORY	9

Entropy - Discrete Memoryless channels - Channel Capacity -Hartley - Shannon law - Source coding theorem - Huffman & Shannon - Fano codes

TEXT BOOK(S):

1. J.G.Proakis, M.Salehi, Fundamentals of Communication Systems, Pearson Education 2014.
2. Simon Haykin, Communication Systems, 4th Edition, Wiley, 2014.

REFERENCE(S):

1. B.P.Lathi, Modern Digital and Analog Communication Systems, 3rd Edition, Oxford University Press, 2007.
2. D.Roody, J.Coolen, Electronic Communications, 4th edition PHI 2006
3. A.Papoulis, Probability, Random variables and Stochastic Processes, McGraw Hill, 3rd edition, 1991.
4. B.Sklar, Digital Communications Fundamentals and Applications, 2nd Edition Pearson Education 2007.
5. H P Hsu, Schaum Outline Series Analog and Digital Communications TMH 2006.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-IV	ES
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ES401	CONTROL SYSTEM ENGINEERING	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is to

- Gain knowledge on system representation and time response of a system.
- Understand the time response of various controllers
- Study about stability of systems
- Study the frequency response through Nyquist, Polar and Bode Plots
- To learn about state variable analysis

Course Outcomes: At the end of this course, learners will be able to:

- Determine the transfer function of systems
- Determine the time response of the systems
- Check the stability of the system
- Determine the frequency response of the systems
- Apply state space analysis to continuous and discrete time system

Unit I	SYSTEM REPRESENTATION	12

Open loop and closed loop systems-Terminology and basic structure- Elements of closed loop systems - Transfer function concept- Modeling of mechanical systems, Block diagram reduction techniques - Signal flow graphs - Mason's gain formula

Unit II	TIME RESPONSE ANALYSIS	12

Standard test signals - Time response of First and Second order system for step input and ramp input time response specifications - Type of systems - Steady state error constants, generalized error series - Basics of PD, PI, PID Controller

Unit III	STABILITY OF SYSTEMS	12

Stability and the roots of characteristic equation- Routh Hurwitz criterion of stability- Range for parameters - conditionally stable systems- Root locus technique -Rules for root locus plot- Stability analysis.

Unit IV	FREQUENCY RESPONSE ANALYSIS	12

Frequency domain specifications - Peak resonance, resonant frequency, bandwidth and cut-off rate – Polar plot -Bode plot -Gain plot, phase plot, gain margin and phase margin- Nyquist plots - Stability in frequency domain -Nyquist criterion

Unit V	STATE VARIABLE ANALYSIS	12

Introduction to state space analysis- State model of linear systems-State phase representation using physical variables, phase variable and canonical variables - State transition matrix, Concept of Controllability and Observability, State space representation of discrete time system

TEXT BOOK(S):

1. I.J.Nagrath, and M.Gopal, Control Engineering, New Age International, 2007.
2. M.N.Bandyapadhyay, Control Engineering, PHI, 2003.

REFERENCE(S):

1. Ogata K, Modern Control Engineering, Tata McGraw Hill, 2005.
2. D.Roy Choudhury, Modern Control Engineering, PHI, 2006

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester IV	EEC
Course Code	Course Name	Hours/Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HS401	LANGUAGE SKILLS	0	0	2	0	30	100	

Course Objective (s): The purpose of learning this course is

- To involve the students in effective listening activities.
- To improve the oral communication skills in proper manner.
- To focus the effective reading of general and technical text.
- To enhance and comprehend the written text.
- To integrate LSRW skills.

Course Outcomes: At the end of this course, learners will be able to

- Understand the technical talks.
- Communicate to his peer group properly.
- Comprehend the general and technical text.
- Write the reports and job application in clear manner.
- Integrate LSRW skills.

Unit I	LISTENING	6

Listening and its importance –Listening strategies - Listen to a process information - give information, as part of a simple explanation - Being an active listener: giving verbal and non-verbal feedback - taking lecture notes

Unit II	SPEAKING	6

Give personal information - ask for personal information - express ability - ask for clarification - pronunciation basics - pronunciation practice - conversation starters: Pep talk - stressing syllables and speaking clearly - summarizing academic readings and lectures

Unit III	READING	6

Strategies for effective reading - Read and recognize different types of texts - Predicting content using photos and title - Read for details - Use of graphic organizers to review and aid comprehension - Understanding pronoun reference and use of connectors in a passage- speed reading techniques

Unit IV	WRITING	6

Plan before writing - Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph – Write a paragraph with reasons and examples - Write an opinion paragraph – E-mail writing - Types of essays- descriptive-narrative- issue-based-argumentative-analytical

Unit V	INTEGRATION OF LSRW	6

Task based Instruction : watching a video –Listing, Sorting, ordering, comparing and analyzing the ideas – Reading a newspaper and creating topic based videos

TEXT BOOKS:

1. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015

REFERENCES:

1. Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015.
2. Interact English Lab Manual for Undergraduate Students, OrientBalckSwan: Hyderabad, 2016.
3. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
4. S. Hariharan etal. Soft Skills. MJP Publishers: Chennai, 2010

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	IV
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19TPS04	QUANTITATIVE APTITUDE AND LOGICAL REASONING - II	2	0	0	0	30	100	

Course Objective (s): The purpose of learning this course is to

- Learn the basic of partnership and chain rule in simplified way.
- Solve problems using fast track method by learning profit and loss with percentage.
- Teach the angle of elevation and depression.
- Know the relationship, direction concepts in easy way.
- Know about coding and decoding through logical way.

Course Outcomes: At the end of this course, learners will be able to:

- Solve problems by using shortcut in partnership and chain rule.
- Know the tips and tricks of profit and loss with percentage through fast track methods.
- Understand the concepts of angles.
- Evaluate critically the real life situations by resorting and analyzing analytical reasoning of key issues and factors.
- Enhance the logical way of thinking by solving problems codes and rankings concepts.

UNIT 1	PARTNERSHIP & CHAIN RULE	6

PARTNERSHIP: Ratio of division of gains: Simple Partnership – Compound Partnership - Working and sleeping partners.
CHAIN RULE: Definition – Direct proportion and Indirect proportion.

UNIT 2	PROFIT & LOSS, PERCENTAGE	6

PROFIT AND LOSS: Basic definition and types of profit and loss – Concept of discount and marked price – Concept of true v/s false value – Application in data interpretation problems.
PERCENTAGE: Percentage – Percentage using shortcuts.

UNIT 3	HEIGHT AND DISTANCE	6

HEIGHT AND DISTANCES: Line of sight – Angle of elevation – Angle of depression.

UNIT 4	BLOOD RELATIONSHIP & DIRECTION SENSE TEST	6

BLOOD RELATIONSHIP: Analysis the gender relationship –Relationship diagram - Family tree.
DIRECTION SENSE TEST: Distance between the starting and ending points - Sense the direction correctly.

UNIT 5	LOGICAL SEQUENCE OF WORD, CODING AND DECODING, NUMBER RANKING & TIME SEQUENCE TEST	6

LOGICAL SEQUENCE OF WORDS: Sequence of occurrence of events – Sequence of objects in a class or group – Sequence of increasing/decreasing size, value, intensity, etc.
CODING AND DECODING: Introduction – Description of coding method, Coding patterns – Concepts of coding & decoding – Problems involving coding & decoding method.
NUMBER RANKINGS & TIME SEQUENCE TEST: Number test – Ranking test – Time sequence test.

TOTAL : 30 HOURS

REFERENCES:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.
3. R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.
4. Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.
5. Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018
6. "Reasoning and Aptitude" for GATE and ESE Prelims, Made Easy Publication,2020.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-IV	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
19EC404	LINEAR INTEGRATED CIRCUITS LABORATORY	L	T	P	C	30	100	
		0	0	2	1			

Course Objective (s): The purpose of learning this course is to

- Understand the basics of linear integrated circuits using op-amps
- Design the circuits using the operational amplifier.
- Apply operational amplifiers in linear and nonlinear applications.
- Acquire the basic knowledge of special function IC.
- Acquire the basic knowledge ADC/DAC circuits

Course Outcomes: At the end of this course, learners will be able to:

- Design amplifiers, oscillators, D-A converters using operational amplifiers.
- Design filters using op-amp and performs an experiment on frequency response.
- Analyze the working of PLL and describe its application as a frequency multiplier.
- Design of ADC/DAC circuits using op-amps
- Design the voltage regulators.

Exp No.	Name of Experiments
1	Design and testing of Inverting, Non-Inverting Amplifiers, Summer, Subtractor, Differentiator and Integrator using op-amps and Spice Simulation.
2	Design and testing of Precision half wave and Full wave rectifiers using op-amps and Spice Simulation.
3	RC phase shift and wein bridge oscillator using Op-Amps-Multisim
4	Design and testing of Comparator, Zero crossing Detectors, Peak Detector and Schmitt trigger using op-amps and Spice Simulation.
5	Design of Astable and Monostable Multivibrator & Schmitt trigger circuit using IC 741
6	Design and testing of Active Analog Filters using op-amp.
7	Astable multivibrator ,Monostable multivibrator & Schmitt trigger circuit using IC 555
8	Design of D/A Converter using R-2R ladder network and A/D Convertor using flash type.
9	Study of Phase Locked Loop (PLL) and Spice Simulation.
10	Voltage regulator using 78XX and Spice Simulation.

List of Equipment:

- CRO/DSO (Min 30MHz) -- 15 Nos
- Signal Generator /Function Generators (2 MHz) – 15 Nos
- Dual Regulated Power Supplies (0 – 30V) -- 15 Nos
- Digital Multimeter -- 15 Nos
- IC Tester -- 5 Nos
- Standalone desktops PC -- 15 Nos
- Components and Accessories – 50 Nos
- Components and Accessories: Transistors, Resistors, Capacitors, diodes, Zener diodes, Bread Boards, Transformers, wires, Power transistors, Potentiometer, A/D and D/A convertors, LEDs .
  Note: Op-Amps uA741, LM 301, LM311, LM 324, LM317, LM723, 7805, 7812, 2N3524, 2N3525, 2N3391, AD 633, LM 555, LM 565 may be used.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-IV	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
19EC405	DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C	30	100
		0	0	2	1		

Course Objective (s): The purpose of learning this course is to

- Perform basic signal processing operations of CT and DT signals
- Perform basic signal processing operations such as Linear Convolution and correlation methods
- Implement FIR and IIR filters in MATLAB and DSP Processor
- Study the arithmetic operations of DSP processor
- Design of convolution and filter circuits

Course Outcomes: At the end of this course, learners will be able to:

- Design of basic signal processing operations of CT and DT signals
- Design of Linear Convolution and correlation methods
- Design of FIR and IIR filters in MATLAB and DSP Processor
- Analyze the operations of basic arithmetic circuits using DSP processors
- Implementation of convolution and filter circuits.

Exp No.	Name of Experiments
Using Matlab	
1	Generation of basic continuous-time (CT) and Discrete time (DT) signals i) unit impulse ii) unit step iii) ramp iv) exponential v) sinusoid vi) sinc vii) square viii) signum ix) triangle
2	Basic operation on CT and DT signals i) time reversal ii) time shifting iii) time scaling iv) signal addition v) signal multiplication vi) combination of various operations
3	Computation of convolution and Correlation of given signals
4	Overlap add and overlap save method for performing Convolution
5	Implementation of FFT algorithm.
6	Sampling and Reconstruction of a signal
7	IIR Filter Design using bilinear transformation and impulse invariant technique.
8	FIR Filter design using windows.
9	Graphical simulations and modeling of an image using MATLAB
10	Modeling and Prototyping With Simulink
Using DSP Processor	
11	Arithmetic operation using Digital Signal Processor.
12	Wave form generation using Digital Signal Processor.
13	Implementation of FIR filter using Digital Signal Processor

List of Equipment:

- PCs with Fixed / Floating point DSP Processors (Kit / Add-on Cards) 15 Units
- MATLAB with Simulink and Signal Processing Tool Box or Equivalent Software in desktop systems - 15 Nos
- Signal Generators (1MHz) – 15 Nos
- CRO (20MHz) -15 Nos

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Dept.of ECE - ESEC

SEMESTER-V

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester V	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC501	ANTENNAS AND WAVE PROPAGATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Learn radiation from a current element.
- Understand antenna arrays
- Study aperture antennas
- Learn special antennas such as frequency independent and broad band antennas.
- Study radio wave propagation.

Course Outcomes: At the end of this course, learners will be able to:

- Illustrate about the radiation from a current element.
- Analyze the antenna arrays
- Investigate the aperture antennas and its radiation mechanisms.
- Explain the various types of special antennas and antenna measurements.
- Explore the nature of the wave propagation in various layers of atmosphere

Unit I	BASIC ANTENNA CONCEPTS	9

Definition of Antenna parameters- Radiation Pattern, Beam solid angle, Radiation intensity, Radiation Power density, Directivity, Gain, Effective aperture, Polarization, Bandwidth, Beam width, antenna impedance, Poynting vector-Friis Transmission formula, Duality of Antennas, Radiation from oscillating dipole, half-wave dipole, Folded dipole and Yagi array.

Unit II	ARRAY ANTENNAS	9

Antenna Arrays: Definition, Power patterns, Array of two point sources – Pattern multiplication, Broad side array, End fire array, N-element linear array, Evaluation of null directions and maxima, amplitude distributions, Binomial arrays, Dolph-Chebychev arrays.

Unit III	APERTURE ANTENNAS	9

Aperture Antennas: Magnetic Current and its fields, Uniqueness theorem, Field equivalence principle, Duality principle, Method of Images, Pattern properties, Slot antenna, Horn Antenna, Pyramidal Horn Antenna, Reflector Antenna-Flat reflector, Corner Reflector, Common curved reflector shapes, Lens Antenna.

Unit IV	SPECIAL ANTENNAS AND ANTENNA MEASUREMENTS	9

Special Antennas: Long wire, V and Rhombic Antenna, Yagi-Uda Antenna, Turnstile Antenna, Helical Antenna- Axial mode helix, Normal mode helix, Biconical Antenna, Log periodic Dipole Array, Spiral Antenna and Microstrip Patch Antennas.

Antenna Measurements: Radiation Pattern measurement, Gain and Directivity Measurements, Anechoic Chamber measurement.

Unit V	WAVE PROPAGATION	9

Propagation in free space - propagation around the earth - Surface wave propagation - structure of the ionosphere - propagation of plane waves in ionized medium - determination of critical frequencies - maximum usable frequency - effect of the earth's magnetic field – ionosphere variations – fading - troposphere propagation - space wave propagation- super refraction -refractive index of troposphere-scatter propagation.

TEXT BOOK(S):

1. Balanis E S, Antenna Theory Analysis and Design, John Wiley and Sons Inc, 4th Edition, Singapore, 2016.
2. John D Kraus," Antennas for all Applications", 3rd Edition, Mc Graw Hill, 2008.

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REFERENCE(S):	
1.	Harish A R and Scahidananda M, Antennas and Wave Propagation, Oxford University Press, Chennai, 2009
2.	Edward C Jordan, Keith G Balmain, Electromagnetic waves and Radiating systems, Prentice Hall of India, New Delhi, 2015.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-V	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EC502	DIGITAL COMMUNICATION	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Understand the concept of sampling and pulse code modulation
- Know the concept of Eye pattern to analyze ISI
- Understand about digital modulation techniques
- Know the concept and details of digital modulation techniques
- Enumerate the idea of error coding techniques.

Course Outcomes: At the end of this course, learners will be able to:

- Apply the concept of sampling and pulse code modulation for analog signals.
- Apply the concept of Eye pattern to analyze ISI.
- Acquire knowledge about digital modulation techniques
- Apply the concept of error control coding to detect and correct the error in digital data transmission.
- Implement the concept of various error coding methods.

Unit I	INFORMATION THEORY	9

Discrete Memory less source, Information, Entropy, Mutual Information - Discrete Memory less channels – Binary Symmetric Channel, Channel Capacity - Hartley - Shannon law - Source coding theorem - Shannon - Fano & Huffman codes.

Unit II	WAVEFORM CODING & REPRESENTATION	9

Prediction filtering and DPCM - Delta Modulation - ADPCM & ADM principles-Linear Predictive Coding- Properties of Line codes- Power Spectral Density of Unipolar / Polar RZ & NRZ – Bipolar NRZ - Manchester

Unit III	BASEBAND TRANSMISSION & RECEPTION	9

ISI – Nyquist criterion for distortion less transmission – Pulse shaping – Correlative coding - Eye pattern – Receiving Filters- Matched Filter, Correlation receiver, Adaptive Equalization

Unit IV	DIGITAL MODULATION SCHEME	9

Geometric Representation of signals - Generation, detection, PSD & BER of Coherent BPSK, BFSK & QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers - Principle of DPSK.

Unit V	ERROR CONTROL CODING	9

Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder

TEXT BOOK(S):

1. S. Haykin, Digital Communications, John Wiley, 2014.

REFERENCE(S):

1. B. Sklar, Digital Communication Fundamentals and Applications, 3rd Edition, Pearson Education, 2018
2. B.P.Lathi, Modern Digital and Analog Communication Systems 5th Edition, Oxford University Press 2019.
3. H P Hsu, Schaum Outline Series Analog and Digital Communications, 2nd Edition TMH 2003
4. J.G Proakis, Digital Communication,5th Edition, Tata Mc Graw Hill Company, 2008

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Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-V	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EC503	MICROPROCESSOR, MICROCONTROLLER AND INTERFACING	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Know the basic concepts of digital fundamentals to Microprocessor
- Understand the interfacing techniques of various controllers.
- Study about 89C51 controller and instruction sets.
- Know the architecture and assembly language programming
- Understand the concept of interrupts and interfacing with various peripherals.

Course Outcomes: At the end of this course, learners will be able to:

- Apply the basic concepts of digital fundamentals to Microprocessor based personal computer system.
- Program microprocessor applications using assembly language programming.
- Illustrate how the different peripherals (8255, 8279, 8253, 8237, 8251, 8259) are interfaced with Microprocessor.
- Design, develop and interface complete microcontroller based systems to peripheral devices using PIC microcontroller.
- Illustrate how the different peripherals are interfaced with PIC microcontroller.

Unit I	8086 MICROPROCESSOR PROGRAMMING AND STACK	9

Register organization of 8086 – Architecture - Physical memory organization - I/O addressing capability - Addressing modes of 8086 - Instruction set of 8086: Data transfer instructions - String instructions- Logical instructions - Arithmetic instructions - Transfer and control instructions - Processor control instructions. Simple Assembly Language Programming - Introduction to stack - Interrupt and interrupt service routines-Time delays using counter

Unit II	I/O INTERFACING	9

Memory Interfacing and I/O interfacing – Parallel communication interface (8255) – Serial communication interface (8251) – D/A and A/D Interface – Timer (8253) – Keyboard /display controller (8279) – Interrupt controller (8259) – DMA controller (8273) – Programming and applications Case studies: Traffic Light control, LED display, LCD display, Keyboard display interface and Alarm Controller.

Unit III	89C51 MICROCONTROLLER	9

Introduction to RISC and CISC machines – 89c51 Microcontroller hardware block diagram - Data and program memory mapping - Register organization - I/O pins - Ports and circuits - Interfacing to external memory- Instruction sets - Addressing modes

Unit IV	89C51 PROGRAMMING	9

Assembly language programming -Timer and counter programming – Serial Data Communication using MAX232 converter – Interrupt programming.

Unit V	89C51 INTERFACING WITH PERIPHERALS	9

LED - Seven segment display – Switch interfacing – LCD-ADC0809 with LM35 sensor - Stepper motor - Speed control of DC motor - Matrix keypad – Case study: Voice Operated Home Appliances for Physically challenged.

TEXT BOOK(S):

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, Lyla B Das, Microprocessors and Microcontrollers, Pearson Education Asia, New Delhi, 2013, ISBN: 9788131789568

REFERENCE(S):

1. Ray K., and Bhurchandi K. M., Advanced Microprocessors and Peripherals: Architecture, Programming and Interface, 3rd Edition, Tata McGraw Hill, New Delhi, 2015, ISBN: 9780070140622
2. Patel, The 8051 Microcontroller Based Embedded Systems, 1st Edition, McGraw Hill Education, New Delhi, 2014, ISBN : 9789332901254

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3.	http://www.nptel.ac.in/courses/Webcourse-contents/IISc- BANG/ Microprocessors%20 and%20 Microcontrollers / New_index1.html
4.	http://nptel.ac.in/courses/106108100/

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-V	HS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19HS402	UNIVERSAL HUMAN VALUES 2 : UNDERSTANDING HARMONY	2	1	0	3	60	100

Course Objective (s): The purpose of learning this course is to

- To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature

Course Outcomes: At the end of this course, learners will be able to:

- Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
- Students would become more responsible in life, and in handling problems with sustainable solutions.
- Students become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- Students would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction .
- Students would have better critical ability

Unit I	Introduction to Value Education	9+3

Lectures - Understanding Value Education - Self-exploration as the Process for Value Education - Continuous Happiness and Prosperity – the Basic Human Aspirations - Right Understanding, Relationship and Physical Facility - Happiness and Prosperity – Current Scenario - Method to Fulfill the Basic Human Aspirations

Tutorials [Practice Session] - Sharing about Oneself - Exploring Human Consciousness - Exploring Natural Acceptance

Unit II	Harmony in the Human Being	6+3

Lectures - Understanding Human being as the Co-existence of the Self and the Body - Distinguishing between the Needs of the Self and the Body – The Body as an Instrument of the Self - Understanding Harmony in the Self - Harmony of the Self with the Body - Programme to ensure self-regulation and Health

Tutorials [Practice Session] - Exploring the difference of Needs of Self and Body - Exploring Sources of Imagination in the Self - Exploring Harmony of Self with the Body

Unit III	Harmony in the Family and Society	6+3

Lectures - Harmony in the Family – the Basic Unit of Human Interaction - Values in Human-to-Human Relationship – 'Trust' – the Foundational Value in Relationship - 'Respect' – as the Right Evaluation - Understanding Harmony in the Society - Vision for the Universal Human Order

Tutorials [Practice Session] - Exploring the Feeling of Trust - Exploring the Feeling of Respect - Exploring Systems to fulfil Human Goal

Unit IV	Harmony in the Nature/Existence	9+3

Lectures - Understanding Harmony in the Nature - Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature – Realizing Existence as Co-existence at All Levels - The Holistic Perception of Harmony in Existence

Tutorials [Practice Session] - Exploring the Four Orders of Nature - Exploring Co-existence in Existence

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Unit V	Implications of the Holistic Understanding	9+3
Lectures - Natural Acceptance of Human Values - Definitiveness of (Ethical) Human Conduct – A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order - Competence in Professional Ethics - Holistic Technologies, Production Systems and Management Models-Typical Case Studies - Strategies for Transition towards Value-based Life and Profession **Tutorials** [Practice Session] - Exploring Ethical Human Conduct - Exploring Humanistic Models in Education - Exploring Steps of Transition towards Universal Human Order		

TEXT BOOK(S):	
1.	A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034-53-2

REFERENCE(S):	
1.	Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999
2.	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004
3.	The Story of Stuff (Book)
4.	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5.	Small is Beautiful - E. F Schumacher
6.	Slow is Beautiful - Cecile Andrews
7.	Economy of Permanence - J C Kumarappa
8.	Bharat Mein Angreji Raj – PanditSunderlal
9.	Rediscovering India - by Dharampal
10	Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

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Dept.of ECE - ESEC

Department	COMMON TO ALL BRANCHES					R 2019	Semester	V
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19TPS05	QUANTITATIVE APTITUDE AND LOGICAL REASONING - III	2	0	0	0	30	100	

Course Objective (s): The purpose of learning this course is to

- Design to help people make sense of numerical data.
- Calculate the calendars and series in simplified way.
- Understand the concept of the interest amount in SI and CI.
- Know the procedure to deal with a situation and sufficient to determine the answer.
- Teach seating arrangements in rows or in small groups.

Course Outcomes: At the end of this course, learners will be able to:

- Demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken to solve Aptitude Questions.
- Solve the question based on calendar, odd man out and series by using shortcut methods.
- Calculate the interest by using shortcut methods instead of traditional methods.
- Induce their critical thinking by solving the syllogism and course of action.
- Analyze the conditions and do interpretation.

UNIT 1	DATA INTERPRETATION & CLOCKS	6

DATA INTERPRETATION: Tabulation – Bar graphs – Pie charts – Line graphs.
CLOCKS: Definition – important points – Angular difference between two hands at different timings- Incorrect clock.

UNIT 2	CALENDARS, ODDMAN OUT & SERIES	6

CALENDARS: Odd days – Leap year – Ordinary year – Counting of odd days – Day of the week.
ODDMAN OUT & SERIES: Odd man out – Power series – Number series-Sequence of real numbers.

UNIT 3	SIMPLE & COMPOUND INTEREST	6

SIMPLE INTEREST: Principal – Rate of interest – Number of years – Using formulae and shortcuts methods.
COMPOUND INTEREST: Compounded Annually – Compounded Half-Yearly – Compounded Quarterly – Compounded annually – Rates are different for different years.

UNIT 4	STATEMENT & COURSE OF ACTION, SYLLOGISM	6

STATEMENT AND COURSE OF ACTION: Courses of action - Decision taken - Improvement, Follow-up or further action in regard to the given statement.
SYLLOGISM/ LOGICAL VENN DIAGRAMS: Relationship between the two things or not - Classification of propositions – Immediate deductive inference – Immediate deductive inference.

UNIT 5	SEATING ARRANGEMENTS & DATA SUFFICIENCY	6

SEATING ARRANGEMENTS: Persons seating in the circular – Rectangular – Square.
DATA SUFFICIENCY: Reasoning ability using a set of directions.

TOTAL : 30 HOURS

REFERENCES:

1. Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012
2. Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.
3. R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.
4. Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.
5. Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018.
6. "Reasoning and Aptitude" for GATE and ESE Prelims, Made Easy Publication,2020.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-V	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC504	MICROPROCESSOR, MICROCONTROLLER AND INTERFACING LABORATORY	0	0	2	1	30	100	

Course Objective (s): The purpose of learning this course is to

- Understand and analyse instruction sets of 8086 microprocessor and 89c51 microcontroller.
- Gain hands-on experience in doing experiments on microprocessors (8086) and 89c51 Microcontroller.
- interface the microprocessor / microcontroller with various peripherals for various applications
- Able to use an Integrated Development Environment (IDE) as a modern software tool for Embedded system development.

Course Outcomes: At the end of this course, learners will be able to:

- Perform the basic operations of 8086 microprocessor using Assembly language Programming.
- Perform various operations like sorting, finding the maximum & minimum numbers & string operations using 8086 microprocessor
- Interface 8085/8086 microprocessor to implement various operations likeADC,DAC,8279,Traffic Light controller
- Perform basic operations using 89c51 Microcontroller.
- Generate an interrupt, LED operations using push button and Input capture operations using 89c51

Exp No.	Name of Experiments
1	Arithmetic operations using 8086.
2	Sorting, searching and string manipulation using 8086
3	Hex. to ASCII/BCD code conversion using 8086 microprocessor
4	Matrix Addition / Subtraction using 8086 microprocessor
5	Addition / Subtraction / Multiplication / Division using 89c51 microcontroller
6	Interfacing of switch and LED with 89c51/8086 microcontroller
7	Interfacing of ADC with 89c51/8086 microcontroller.
8	Interfacing of DAC with 89c51/8086 microcontroller.
9	Stepper Motor/DC Motor interfacing with 89c51/8086 microcontroller
1	UART /LCD interfacing with 89c51/8086 microcontroller

List of Equipment:

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:
HARDWARE: 8086 development kits - 30 nos

- Interfacing Units - Each 10 nos
- Microcontroller - 30 nos

SOFTWARE: Intel Desktop Systems with MASM - 30 nos
8086 Assembler 8051 Cross Assembler

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-V	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC505	COMMUNICATION SYSTEMS LABORATORY	0	0	2	1	30	100	

Course Objective (s): The purpose of learning this course is to

- Understand the fundamental communication system parameters such as bandwidth, power, signal to quantization noise ratio and data rate.
- Learn the digital modulation techniques (QPSK and QAM) and their detection.
- Know the concept and details of source coding and error control coding techniques

Course Outcomes: At the end of this course, learners will be able to:

- Design a transistor based digital pulse modulation
- Analyze the characteristics of analog and digital channels in a communication systems
- Design and analyze different line coding techniques for transmission of digital data
- Design and analyze different source & error control coding techniques in digital transmission.
- Analyze the characteristics of pulse shaping circuits in digital communication

Exp No.	Name of Experiments
1	AM modulation and demodulation
2	FM transmitter & receiver
3	Signal sampling and reconstruction
4	PAM,PPM,PWM modulation and demodulation
5	Pulse code modulation and demodulation
6	Delta modulation and demodulation
7	Time Division Multiplexing
8	Modulation and demodulation of shift keying techniques
9	Radiation pattern measurement of dipole antenna
10	Radiation pattern measurement of Yagi-uda antenna
11	Design and simulate the shift keying techniques
12	Simulation of convolution coding scheme.

List of Equipment:

LAB Requirements for a Batch of 30 students (3 students per experiment):

- Kits for Signal Sampling, TDM, AM, FM, PCM, DM and Line Coding Schemes
- CROs/DSOs – 15 Nos, Function Generators – 15 Nos.
- MATLAB or equivalent software package for simulation experiments
- PCs - 15 Nos

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-V	EEC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EC506	MINI PROJECT	0	0	2	1	30	100

Course Objective (s): The purpose of learning this course is to

- Conceptualize a novel idea / technique into a product
- Apply the acquired knowledge to carry out a capstone project having substantial multidisciplinary component
- Understand the management techniques of implementing a project
- Take on the challenges of teamwork,
- Prepare a presentation in a professional manner, and document all aspects of design work.

Course Outcomes: At the end of this course, learners will be able to:

- Have hands-on experience in converting a small novel idea / technique into a working model / prototype
- Involving multi-disciplinary skills and / or knowledge and working in at team.

Guidelines

The students in a group of 5 to 6 works on a topic approved by the head of the department and prepares a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

Learning Resources

IEEE Journal, Elsevier Journals, Springer Jour nals, and any open access journal, reference / user manuals, etc.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester - V	EEC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC507	INTERNSHIP / INDUSTRIAL TRAINING	0	0	2	1	30	100	

Course Objective (s): The purpose of learning this course is to

- Understand one or more practical application of the core courses learned
- Get an inside view of an industry and organization/company
- Gain valuable skills and knowledge
- Make professional connections and enhance networking
- Get experience in a field to allow the student to make a career transition

Course Outcomes: At the end of this course, learners will be able to provide short-term work experience in an Industry/ Company/ Organization

Guidelines

1. It is mandatory for every student to undergo this course.
2. Every student is expected to spend a minimum of 15-days in an Industry/ Company/ Organization, during the vacation.
3. The student must submit the "Training Completion Certificate" issued by the industry / company / Organization as well as a technical report not exceeding 15 pages, within the stipulated time to be eligible for making a presentation before the committee constituted by the department.
4. The committee assesses the student performance, based on the report submitted and the presentation made.

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SEMESTER-VI

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VI	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS403	COMPUTER NETWORKS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is

- To study the concepts of data communications and functions of different layers of ISO/OSI
- reference architecture
- To understand the error detection and correction methods and types of LAN
- To study the concepts of sub netting and routing mechanisms.
- To understand the different types of protocols and network components.
- To study the application protocols and network security

Course Outcomes: At the end of this course, learners will be able to:

- Understand the fundamentals of data communications and functions of layered architecture.
- Practice the error detection and correction methods and understand the different network technologies
- Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and routing technologies
- Understand the transport layer principles and reliable data transfer
- Understand the application layer protocols and also the use of cryptography and network security

Unit I	DATA COMMUNICATIONS AND PHYSICAL LAYER	9

Introduction, history and development of computer networks, networks topologies, ISO/OSI model and protocols. Different types of transmission media, errors in transmission: attenuation, noise. Repeaters. Encoding (NRZ, NRZI, Manchester, 4B/5B). MAC Layer: Aloha, TDMA, CDMA, CSMA/CD, CSMA/CA.

Unit II	DATA LINK LAYER	9

Error detection (Parity, CRC, Hamming code), Sliding Window, Stop and Wait protocols, LAN: Design, specifications of popular technologies, switching, Ethernet, Gigabit Ethernet, Token Ring, Token Bus, Bluetooth, Wi-Fi, Wi-Max, FDDI, PPP, bridging and SDN.

Unit III	NETWORK LAYER	9

Internet Protocol, IPv6, ARP, DHCP, ICMP, Distance vector routing, Link state routing, Classless Inter-domain routing, RIP, OSPF, BGP, Subnetting, , Network Address Translation.

Unit IV	TRANSPORT LAYER	9

UDP, TCP, Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission, TCP extensions, Design issues in protocols at different layers, Socket Programming.

Unit V	APPLICATION LAYER	9

DNS, E-Mail -SMTP, MIME, POP3, IMAP, FTP, HTTP, WWW, symmetric and asymmetric key cryptography, Sharing of symmetric keys – Diffie-Hellman key Exchange, Public Key Infrastructure, Public Key Authentication Protocols, Firewalls.

TEXT BOOK(S):

1. AS Tanenbaum, DJ Wetherall, "Computer Networks", 5th Edition, Prentice-Hall, 2013.
2. Behrouz A. Forouzan, "Data communication and Networking", 4th Edition, Tata McGraw Hill, 2017

REFERENCE(S):

1. Peterson & Davie, "Computer Networks, A Systems Approach", 3rd Edition, Harcourt, 2013
2. William Stallings, "Data and Computer Communications", 10th Edition, PHI, 2017

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-VI	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19EC601	MOBILE COMMUNICATION	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Understand the concepts of 2G,3G and 4G network technology
- Understand the concepts of mobile radio propagation
- Study about wireless channel modeling
- Know about Spread Spectrum Systems and access methods.
- Analyze capacity of wireless network channels

Course Outcomes: At the end of this course, learners will be able to:

- Apply concepts of 2G,3G and 4G network technology
- Design concepts of mobile radio propagation
- Design wireless channel modeling
- Explain about Spread Spectrum Systems and access methods.
- Discuss capacity of wireless network channels

Unit I	INTRODUCTION	9

Introduction to wireless communication systems-Modern wireless communication systems: 2G - 3G- 4G cellular Architecture –WLAN-PAN- Cellular concept- system design fundamentals Handoff Strategies- Interference and system capacity, Improving Coverage and Capacity.

Unit II	MOBILE RADIO PROPAGATION	9

Free space propagation model, Three basic propagation mechanisms, Reflection-Two-Ray model, Diffraction – Knife-edge diffraction model, Scattering, Log-normal shadowing, Okumara model, Hata model, Log-distance path loss model.

Unit III	WIRELESS CHANNEL MODELING	9

Small-scale multipath propagation, Parameters of mobile multipath channels, Types of small scale fading, Rayleigh and Ricean distribution, Physical modeling for wireless channels - Input /output model of the wireless channel - Time and frequency coherence - Statistical channel models.

Unit IV	MODULATION AND MULTIPLE ACCESS SCHEMES	9

OFDM Modem, Spread Spectrum Systems, RAKE receiver-Access methods - FDMA, TDMA - CDMA - SDMA and CSMA, Diversity Techniques

Unit V	CAPACITY OF WIRELESS CHANNELS	9

AWGN channel capacity – capacity of flat fading channels , Frequency-selective fading channels, Downlink channel capacity, Uplink channel capacity, MIMO multiuser system

TEXT BOOK(S):

1. Theodore S. Rappaport, Wireless Communications, Pearson Education, Asia, Second Edition, 2012.
2. David Tse and Pramod Viswanath, Fundamentals of Wireless Communication, Cambridge University Press, 2013.

REFERENCE(S):

1. KamiloFeher, Wireless Digital Communications, Modulation & Spread Spectrum Applications, PHI, 1995.
2. Samuel Y. Lee, Mobile Communication Engineering, McGraw Hill,2nd Edition 2008.
3. Andrea Goldsmith ,Wireless Communications, Cambridge University Press,2015

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VII	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC602	CMOS VLSI DESIGN	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Know about CMOS Fabrication process and Layout Design.
- Understand the concepts of MOS Circuit Design Process.
- Study about CMOS circuits using Various Logic Styles.
- Know the operation of CMOS Memory and Clocking Strategies
- Understand the building block of VLSI system.

Course Outcomes: At the end of this course, learners will be able to:

- Demonstrate CMOS Fabrication process and Layout Design.
- Analyze MOS Circuit Design Process.
- Design the circuits using Various Logic Styles.
- Reveal the operation of CMOS Memory and Clocking Strategies
- Design building block of VLSI system.

Unit I	MODELING OF VERILOG HDL	9

Review of Digital Circuits- Typical Design Flow- Emergence, Importance, Trends and Popularities of HDLs- Basic Concepts- Modeling of HDL (Gate Level, Dataflow, Behavioral, Structural, Switch-Level) - Design of Combinational Circuits: Adder- Ripple Carry adder- Carry look ahead adder-Carry Select adder - Encoder- Multiplexer and Demultiplexer- ALU. Design of Sequential Circuits Synchronous and asynchronous Counter- Shift Registers.

Unit II	MOS TRANSISTOR CHARACTERISTICS	9

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

Unit III	CMOS CIRCUIT FAMILIES	9

Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls. Comparisons of Circuit families- Power dissipation-Low Power Architecture.

Unit IV	SEQUENTIAL CIRCUIT DESIGN	9

Static latches and Registers Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits. Timing Issues : Timing Classification Of Digital System, Synchronous Design.

Unit V	SUBSYSTEM DESIGN	9

CMOS Mux - Equality Detector - Shift and Rotation Operation - Parity generators- Ripple Carry Adder- Carry Look Ahead Adder -Carry Skip Adder - Carry select adder - Carry save adder - Array Multiplier – Braun / Baugh Wooley - Modified Booth Encoded Multiplier.

TEXT BOOK(S):

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, New Delhi, 2003 (unit-1)
2. John P.Uyemura, "Introduction to VLSI circuits and systems", John Wiley & Sons, 2015
3. Neil.H.E Weste David Harris CMOS VLSI Design: A Circuits and Systems Perspective, 4th edition, Pearson Addison Wesley, 2015.

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REFERENCE(S):	
1.	Kamran Eshraghian, Douglas A. Pucknell, Essentials of VLSI Circuits and Systems Prentice Hall of India, 2009.
2.	E. Fabricious, Introduction to VLSI Design, 1st edition, McGraw Hill, 2019
3.	Keng,Lable bick,"CMOS Digital Integrated Circuits", Tata McGraw Hill, 2014

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Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	VI
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19TPS06	QUANTITATIVE APTITUDE AND LOGICAL REASONING - IV	2	0	0	0	30	100	

Course Objective (s): The purpose of learning this course is to

- Ascertains the occurrence of an event on the basis of already present information.
- Use area models to represent the distributive property in mathematical reasoning.
- Calculate the work capacity by chocolate based method.
- Work with time, speed and distance by relative speed concepts.
- Determine how various phenomena are related.

Course Outcomes: At the end of this course, learners will be able to

- Know the outcome of an event developed the concept of probability.
- Calculate the area and surface volume in real time application.
- Understand the concepts of Times and Work and Pipes and Cistern and Correlating the Concepts of both.
- Know the concepts of Time, Speed and Distance and concepts of Boats and Streams.
- Analyze the cause and effect of problems by using critical thinking.

UNIT 1	PROBABILITY , PERMUTATIONS & COMBINATIONS	6

PROBABILITY: Rolling an unbiased dice – Tossing a fair coin – Drawing a card from a pack of well shuffled cards – Picking up balls of certain color from a bag containing balls of different colors.
PERMUTATIONS: Numbers with digits - Words with letters - Arrangements of person in a row - Arrangements of books on a shelf.
COMBINATIONS: Formation of committee – Selection of questions from question papers.

UNIT 2	AREA & VOLUME	6

AREA: Area – Perimeter – Important points about triangle – Quadrilateral – Fast track techniques.
VOLUME: Cuboids – Cube – Cylinder – Cone – Frustum of a cone – Sphere – Hemisphere – Pyramid – their formulas.

UNIT 3	TIME & WORK, PIPE & CISTERNS	6

TIME AND WORK: Introduction – Basic concepts – Leaving and joining – Alternative days – In between days the works starting and ending.
PIPES AND CISTERNS: Introduction - Basic concepts – Capacity of the total liters –Water flow in the tank.

UNIT 4	TIME& DISTANCE, TRAINS, BOATS AND STREAMS	6

TIME AND DISTANCE: Definition – Average speed – Distance covered is same – Distance covered is different – Stoppage time per hour for a train – Time taken with two different modes of transport – Time and distance between two moving bodies.
PROBLEMS ON TRAINS: Basic concepts – Basic formulae – Different types of objects –Two trains crossing each other in both directions – Shortcuts.
BOATS AND STREAMS: Introduction – Speed of man (boat and streams) - Moving same and opposite directions – important formulae.

UNIT 5	STATEMENT - CONCLUSION , ARGUMENTS, CAUSE & EFFECT, ASSERTION & REASON	6

STATEMENT AND CONCLUSION: Statement to be true - Two conclusions together - Logically follows.
STATEMENT AND ARGUMENTS: Arguments strong with respect to the statement.
CAUSE AND EFFECT: Cause and effect relationship between the two statements.
ASSERTION AND REASON: Assertion(A) and Reason(R) – Both (A) and (R) are individually true and (R) - (A) is true but (R) is false – (A) is false but (R) is true.

TOTAL : 30 HOURS

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REFERENCES:

Abhijit Guha, Quantitative Aptitude for Competitive Examinations, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, 2012

Arun Sharma, How to prepare for Data Interpretation for the CAT, First Edition, Tata McGraw-Hill Publishing Company Ltd, 2012.

R.V.Praveen,"Quantitative Aptitude and Reasoning"Third Edition, PHI Learning ,2016.

Dr.R S Aggarwal, Quantitative Aptitude, Revised and Enlarged Edition, S.Chand Publishing Company Ltd, 2017.

Arun Sharma "How to Prepare for Quantitative Aptitude"Eight Edition, McGraw Hill Education,2018.

"Reasoning and Aptitude" for GATE and ESE Prelims, Made Easy Publication,2020.

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Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester - VI	EEC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HS601	PROFESSIONAL SKILLS	0	0	2	0	30	100	

Course Objective (s): The purpose of learning this course is to

- Develop students' communicative competence in English with Listening skills.
- Improve their ability to communicate effectively in interviews.
- Enable the learners to fine-tune their comprehending level of different texts.
- Prepare the error-free documents.
- Strengthen their thinking level and update their knowledge for career growth.

Course Outcomes: At the end of this course, learners will be able to:

- Develop listening skills to comprehend general / technical talks.
- Make effective presentations in group/pair and attend job interviews
- Understand various concepts by reading different texts.
- Enhance the writing skills to express the ideas of the learners.
- Strengthen their soft skills.

Unit I	LISTENING	6

Conversational skills (formal and informal) - Watching Group discussion & effective presentations, Listening/watching interviews conversations, documentaries - Listening to lectures, discussions from TV/ Radio/ Podcast

Unit II	SPEAKING	6

Introduction to Group Discussion - Participating in group discussions - Understanding group dynamics - Different types of Interview format - answering questions - offering information - Mock interviews - Body language
(paralinguistic features) - Articulation of sounds - Intonation - Making effective presentations

Unit III	READING	6

Reading different genres ranging from newspapers, technical articles and short stories - Predicting the content - Gap filling exercises - Sequencing the sentences

Unit IV	WRITING	6

Writing Job applications - Resume preparation - E-mail writing - Letters(formal & informal) - Memos - Reports - Interpreting the visual texts – Common Errors in English - Preparation of Essays

Unit V	CAREER SKILLS	6

Introduction to Employability and Career Skills - developing a long term career plan - making career changes -Time Management - General awareness of Current Affairs - Managing changes - Stress management - Leadership traits - Team work - Intercultural communication - Creative and Critical thinking

TEXT BOOK(S):

1	E. Suresh Kumar et al. Communication for Professional Success. Orient Black swan: Hyderabad, 2015

REFERENCE(S):

1	Butterfield, Jeff Soft Skills for Everyone. Cengage Learning: New Delhi, 2015.
2	Interact English Lab Manual for Undergraduate Students, OrientBalck Swan: Hyderabad, 2016.
3	Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
4	S. Hariharanetal. Soft Skills. MJP Publishers: Chennai, 2010

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VI	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC603	VLSI DESIGN LABORATORY	0	0	2	1	30	100	

Course Objective (s): The purpose of learning this course is to

- Learn Hardware Descriptive Language(Verilog/VHDL)
- Learn the fundamental principles of VLSI circuit design in digital domain
- Learn the fundamental principles of VLSI circuit design in analog domain
- Familiarize fusing of logical modules on FPGAs
- Provide hands on design experience with professional design (EDA) platforms

Course Outcomes: At the end of this course, learners will be able to:

- Model and simulate digital systems using hardware description language like verilog
- Synthesis digital systems from register transfer level to higher level of description
- Implement the logic circuit designs in FPGA board
- Formulate, design and analyze VLSI circuits for various application using design tools
- Layout simulation using EDA tools

Exp No.	Name of Experiments
1	Design and simulation of combinational circuits
2	Design and simulation of Binary Multiplier (Array /Wallace tree/Booth).
3	Design and simulation of MAC
4	Design and simulation of sequential circuits (Counter/Shift Registers).
5	Design and simulation of FSM.
6	Design and implementation of 4-bit Adder (RCA/CLA/CSA).
7	Design and implementation of 4 bit ALU on FPGA board.
8	Design and implementation of 4 bit Ripple Counter
9	Design and implementation of Traffic Light controller / Real Time Clock on FPGA board.
10	Design and simulation of CMOS gates using Microwind / Tanner EDA Tool.

List of Equipment:

- Xilinx ISE/Altera Quartus/ equivalent EDA Tools 10 User License
- Xilinx/Altera/equivalent FPGA Boards 10 no
- Cadence/Synopsis/ Mentor Graphics/Tanner/equivalent EDA Tools 10 User License
- Personal Computer 30 no

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Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VI	PC
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19CS406	NETWORKING LABORATORY	0	0	4	2	60	100	

Course Objective (s): The purpose of learning this course is to
The purpose of learning this course is to

- Know the basic switch set up
- Understand LAN and Router setup
- Learn the configuration of Network and Ethernet address
- Learn configuration of DHCP, Port and ACL
- Understand the RIP Connectivity

Course Outcomes: At the end of this course, learners will be able to:

- Set up switches
- Set up LAN and Router
- Configure Network and Ethernet address
- Configure DHCP, Port, RIP and ACL
- Get Cisco CCNA Certification

List of Experiments

1. Basic switch setup
2. Configuring switch interfaces
3. VLAN and VTP configuration
4. Basic router setup
5. Prepare the Network, perform all the necessary basic configurations for your device.
6. Configure and Activate Serial and Ethernet Addresses and assign appropriate addresses to the device interfaces.
7. Configure the DHCP configurations in the respective routers
8. Configure the Port Security for the ports connected to the switches
9. Configure the access-list in routers
10. Check the Connectivity to all the devices inside your LAN
11. Configure RIP Routing on the Router and verify the Configurations & Connectivity

TEXT BOOK(S)

1.	Abraham Silberschatz, Peter B.Galvin, Greg Gagne, Operating System Concepts. Ninth edition. Addison-Wesley, 2015
2.	Andrew S. Tanenbaum, Modern Operating System, 4th Edition, Prentice Hall of India Pvt. Ltd, 2016.
3.	AS Tanenbaum, DJ Wetherall, "Computer Networks", 5th Edition, Prentice-Hall, 2013.

REFERENCE(S)

1.	Richard Petersen, The Linux Complete Reference, Sixth Edition, McGraw Hill 2017
2.	Richard Blum and Christine Bresnahan , Linux Command Line and Shell Scripting Bible, 3rd Edition Wiley, 2015
3.	Behrouz A. Forouzan, "Data communication and Networking", 4th Edition, Tata McGraw Hill, 2017

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester - VI	EEC
Course Code	Course Name	Hours/ Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC604	COMPREHENSION REVIEW	0	0	2	0	30	100	

Course Objective (s): The purpose of learning this course is to

- To encourage the students to comprehend the knowledge acquired from the first Semester to fifth Semester of B.E Degree Course through periodic exercise.

Course Outcomes:

- At the end of this course, Ability to review, prepare and present technological developments.

Guidelines for Evaluation:

- The students will be assessed 100% internally through weekly test with objective type questions on all the subject related topics.

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SEMESTER-VII

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VII	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC701	MICROWAVE ENGINEERING	3	1	0	4	60	100	

Course Objective (s): The purpose of learning this course is to

- Understand the concepts various waveguide components
- Understand the concepts of microwave semiconductor devices
- Study performance of microwave tubes
- Elaborate the principles of semiconductor microwave oscillators

Course Outcomes: At the end of this course, learners will be able to:

- Analyze various waveguide components
- Analyze the performance of microwave tubes
- Compare various microwave semiconductor devices
- Discuss the principles of semiconductor microwave oscillators
- Design of waveguide components and microwave transmission lines for a given set of parameters

Unit I	MICROWAVE DEVICES AND ITS CHARACTERISTICS	12

Circuit and S parameter representation of N ports- Reciprocity Theorem- Lossless networks and unitary conditions- Effect of changing the reference planes in the S matrix- S Matrix of a Directional Coupler waveguide tees and rat race coupler- Qualitative discussion on: Waveguide Corners- Bends- Twists- Matched loads and movable shorts.

Unit II	MICROWAVE TUBES	12

Two cavity Klystron amplifier - Transit time effect- Velocity modulation - current modulation-bunching - Reflex Klystron- Slow-Wave structures - Helix Traveling-Wave Tubes- Convection Current- Axial Electric Field- Wave Modes- Bandwidth, Power and Gain Considerations - cross field device. Magnetron - power and frequency considerations.

Unit III	MICROWAVE MEASUREMENTS	12

Slotted line VSWR measurement- impedance measurement- insertion loss and attenuation measurements measurement of scattering parameters - Return loss measurement using directional coupler-Introduction to vector network analyzer and its uses- return loss and insertion loss- Measurement of return loss and Insertion loss using Spectrum analyzer.

Unit IV	MICROWAVE SEMICONDUCTOR DEVICES	12

Gunn-Effect -Gunn Diode- Differential Negative Resistance- Modes of Operation- Amplification- Microwave Generation- Read Diode- Physical Description- Avalanche Multiplication- IMPATT Diodes- TRAPATT Diode- BARITT Diode- Principles of Operation- Physical Structures- Parametric Amplifiers Nonlinear. Reactance and Manley Rowe Power Relations.

Unit V	PLANAR TRANSMISSION LINES	12

Introduction- Microstrip Lines- Derivation of Characteristic Impedance of Microstrip Lines using Quasi Static analysis- Losses in Microstrip Lines- Quality Factor Q of Microstrip Lines- Parallel Strip Lines- Characteristic Impedance-Attenuation losses- Coplanar Strip Lines- Shielded Strip Line-Problems

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TEXT BOOK(S):	
1.	David.M.Pozar, Microwave Engineering, John Wiley, 2003
2.	Samuel.Y.Liao, Microwave Devices and Circuits, PHI, 2000
REFERENCE(S):	
1.	Annapurna Das and SisirK.Das,Microwave Engineering, Tata Mc Graw-Hill,2000
2.	R.E.Collin, Foundations for Microwave Engineering - IEEE Press 2002.
3.	BharathiBhat, ShibanK.Koul, Stripline-like transmission lines for microwave integrated circuits. New Age International, 2007

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester- VII	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC702	OPTICAL FIBER COMMUNICATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the concepts of optical fiber communication link structure, characteristics of fiber and fabrication Techniques.
- Understand the concepts Fiber attenuation Mechanisms.
- Know about the characteristics of an optical sources and Detector
- Understand the concept of optical receiver operation
- Study about Analyze power launching and coupling methods

Course Outcomes: At the end of this course, learners will be able to:

- Discuss optical fiber communication link structure, characteristics of fiber and fabrication techniques.
- Analyze the propagation characteristics of an optical signal in different types of fibers.
- Choose appropriate optical source for an application and Analyze power launching and coupling methods.
- Compare the characteristics of optical detectors.
- Analyze optical fiber transmission system.

Unit I	INTRODUCTION	9

Optical Spectral bands, Evolution of fiber optical system -Elements of Optical Fiber Systems –optical Laws and Definitions Optical Fiber Modes and Configurations-– Single Mode Fiber – Graded Index fiber – Fiber Materials-Fiber Fabrication-Fiber optic Cables.

Unit II	ATTENUATION MECHANISMS	9

Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses. Signal Distortion in Optical Wave guides-Information Capacity determination -Group Delay-Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Mode Coupling -Design Optimization of SM fibers-RI profile and cut-off wavelength.

Unit III	OPTICAL SOURCES AND COUPLING	9

LED structures -Light source materials -Quantum efficiency and LED power. Lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Resonant frequencies - Temperature effects. Power Launching and coupling- Lensing schemes-Fiber to fiber joints-Fiber Splicing-Connectors

Unit IV	PHOTODETECTORS AND RECEIVER	9

PIN Photo detector- Avalanche Photodiodes- Photo detector noise- Detector response time- Avalanche multiplication of Noise- Temperature effects. Fundamental Receiver operation - Preamplifiers- Error sources - Receiver Configuration- Probability of error- Quantum limit.

Unit V	OPTICAL FIBER NETWORKS AND MEASUREMENTS	9

Point to point Links- Link and Rise time Power budget-SONET/SDH-WDM-OADM-Optical Ethernet-Solitons- Measurements :Numerical Aperture, Diameter, Attenuation and Dispersion

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TEXT BOOK(S):	
1.	Keiser G, Optical Fiber Communicationsll, McGraw Hill, New Delhi, Fifth edition, 2014
2.	John M. Senior, Optical Fiber Communications Principles and Practicell, PHI, New Delhi, Third edition, 2009.

REFERENCE(S):	
1.	G.P. Agarwal, Fiber optic Communication Systems, John Wiley and sons, Fourth Edition, 2011
2.	Franz J.H. Jain V.K, Optical Communication, Components and systems, Narosa publications, New Delhi, 2000.
3.	Gower, J Optical Communication Systems, PHI, New Delhi, Second edition, Fifth reprint, 2001
4.	K. Mynbaev and Lowell L Scheiner, Fiber Optic Communication Technologyll, Prentice Hall 2001.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester- VII	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC703	EMBEDDED AND REAL TIME SYSTEMS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Gain knowledge of hardware and software architectures of various Embedded Systems
- Program Embedded systems using computing platform
- Learn the various types of networking techniques
- Understand the various types of real-time characteristics
- Perform real time operations in RTOS using various schedules

Course Outcomes: At the end of this course, learners will be able to:

- Gain knowledge of hardware and software architectures of various Embedded Systems
- Able Program Embedded systems using computing platform
- Learn the various types of networking techniques
- Understand the various types of real-time characteristics
- Perform real time operations in RTOS using various schedules

Unit I	EMBEDDED ARCHITECTURE	9

Embedded Computers, Characteristics of Embedded Computing Applications, Embedded system design process- Requirements, Specification, Architectural Design, Designing Hardware and Software Components, System Integration, Unified modeling language (UML), Formalism for System Design- Structural Description, Behavioral Description, Design Example: Model Train Controller.

Unit II	EMBEDDED PROCESSOR AND COMPUTING PLATFORM	9

ARM processor- Architecture and memory organization, Instruction set, Flow of Control, TI C55X Digital Signal processor- Architecture and Memory organization, Addressing modes, Instruction set, Flow of Control, CPU Bus configuration, ARM Bus, SHARC Bus - Design Example : Alarm Clock.

Unit III	NETWORKS	9

Distributed Embedded Architecture- Hardware and Software Architectures, Networks for embedded systems- I2C, CAN Bus, SHARC link ports, Ethernet, Myrinet, Internet, Network-Based design- Communication Analysis, system performance Analysis, Hardware platform design, Allocation and scheduling, Design Examples: Elevator Controller, Ink jet printer- Hardware Design and Software Design, Personal Digital Assistants, Set-top Boxes

Unit IV	REAL-TIME CHARACTERISTICS	9

Clock driven Approach, weighted round robin Approach, Priority driven Approach, Dynamic Versus Static systems, effective release times and deadlines, Optimality of the Earliest deadline first (EDF) algorithm, challenges in validating timing constraints in priority driven systems, Off-line Versus On-line scheduling.

Unit V	REAL TIME OPERATING SYSTEM	9

Operating system services-Process Management-Memory Management-Device and File Management- I/O sub systems- Interrupt routines in RTOS environment- RTOS –Services-Design using RTOS-Principles- Saving of memory and power, Functions and types of RTOS - RTOS cos-II

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TEXT BOOK(S):	
1.	Wayne Wolf, Computers as Components: "Principles of Embedded Computing System Design", Morgan Kaufman Publishers, 2008.
2.	Rajkamal, "Embedded System Architecture – Programming and Design" Tata McGraw- Hill, Fifth reprint, 2010
3.	Jane.W.S. Liu , "Real-Time systems", Pearson Education Asia, 2000

REFERENCE(S):	
1.	C. M. Krishna and K. G. Shin, "Real-Time Systems", McGraw-Hill, 2009
2.	Frank Vahid and Tony Givargi Embedded System Design: "A Unified Hardware/Software Introduction", John Wiley & Sons, 2006

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-VII	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
19EC704	OPTICAL AND MICROWAVE LABORATORY	L	T	P	C	45	100
		0	0	3	1		

Course Objective (s): The purpose of learning this course is to

- Study the characteristic of passive microwave components
- Learn the radiation characteristics of microwave antennas
- Study the characteristics of Microwave sources
- Perform experiment to verify the characteristics of optical source
- Analyze the performance of fiber optic communication link

Course Outcomes: At the end of this course, learners will be able to:

- Measure and analyze the parameters of rectangular waveguides
- Conduct experiments to measure the characteristics of passive microwave components
- Measure and analyze the radiation characteristics of microwave antennas
- Verify the characteristics of Microwave sources
- Measure and verify the characteristics of optical source

Exp No.	Microwave Experiments
1	Reflex Klystron mode characteristics
2	Radiation pattern of Horn antenna
3	Impedance measurement using VSWR
4	Power measurement of Gunn Diode oscillator
5	Characteristics of Gunn Diode oscillator
6	Determination of coupling factor, insertion loss, isolation and directivity of directional
Exp No.	**Optical Experiments**
1	Measurement of Bending loss
2	Measurement of the numerical aperture and data communication system using a fibre-
3	LED/Laser diode characteristics
4	Mode characteristics of an optical fiber & digital link establishment using LED/Laser diode
Exp No.	**Practical applications based experiments**
1	Study the performance of communication through satellite link
2	Study of Connector and splicer in optical fibers
3	Study the Measurement of attenuation in optical fiber using light runner.

List of Equipment:

- Trainer kit for carrying out LED and PIN diode characteristics, Digital multi meter, optical power meter
- Trainer kit for determining the mode characteristics, losses in optical fiber
- Trainer kit for analyzing Analog and Digital link performance, 2 Mbps PRBS Data source, 10 MHz signal generator, 20 MHz Digital storage Oscilloscope
- Kit for measuring Numerical aperture and Attenuation of fiber
- Advanced Optical fiber trainer kit for PC to PC communication, BER Measurement, Pulse broadening.
- MM/SM Glass and plastic fiber patch chords with ST/SC/E2000 connectors
- LEDs with ST / SC / E2000 receptacles – 650 / 850 nm
- PIN PDs with ST / SC / E2000 receptacles – 650 / 850 nm

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester- VII	PC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC705	EMBEDDED AND REAL TIME SYSTEMS LABORATORY	0	0	3	1	45	100	

Course Objective (s): The purpose of learning this course is to

- Learn the working of ARM processor
- Understand the Building Blocks of Embedded Systems
- Learn the concept of memory map and memory interface
- Write programs to interface memory, I/Os with processor
- Study the interrupt performance

Course Outcomes: At the end of this course, learners will be able to:

- Write programs in ARM for a specific Application
- Interface memory, A/D and D/A convertors with ARM system
- Analyze the performance of interrupt
- Write program for interfacing keyboard, display, motor and sensor.
- Formulate a mini project using embedded system

Exp No.	Name of Experiments
1	Study of ARM evaluation system
2	Interfacing ADC and DAC
3	Interfacing LED and PWM.
4	Interfacing real time clock and serial port.
5	Interfacing keyboard and LCD.
6	Interfacing EPROM and interrupt.
7	Mailbox.
8	Interrupt performance characteristics of ARM and FPGA.
9	Flashing of LEDS.
10	Interfacing stepper motor and temperature sensor.
11	Implementing zigbee protocol with ARM.

List of Equipment:

- Embedded trainer kits with ARM board 10 Nos
- Embedded trainer kits suitable for wireless communication 10 Nos
- Adequate quantities of Hardware, software and consumables

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VII	EEC
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC706	PROJECT WORK PHASE- I	0	0	2	2	45	100	

Course Objective (s): The purpose of learning this course is to

- Conceptualize a novel idea / technique into a product
- Apply the acquired knowledge to carry out a capstone project having substantial multidisciplinary component
- To understand the management techniques of implementing a project
- To take on the challenges of teamwork,
- To prepare a presentation in a professional manner, and document all aspects of design work.

Course Outcomes: At the end of this course, learners will be able to:

Have hands-on experience in converting a small novel idea / technique into a working model / prototype

Involving multi-disciplinary skills and / or knowledge and working in at team.

Guidelines

A multidisciplinary project to be taken up by a team of maximum of ten students. Development of prototype product, a 3D model, simulation, blueprint for a larger project and any other development work are permitted. The contribution of the individuals in the project should be clearly brought out. A combined report is to be submitted. A presentation is to be made for the reviewers on the work done by the candidate.

Learning Resources

IEEE Journal, Elsevier Journals, Springer Jour nals, and any open access journal, reference / user manuals, etc.

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SEMESTER-VIII

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VIII	EEC
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19EC801	PROJECT WORK	0	0	12	6	180	100	

Course Objective (s): The purpose of learning this course is to

- Conceptualize a novel idea / technique into a product
- Apply the acquired knowledge to carry out a capstone project having substantial multidisciplinary component
- To understand the management techniques of implementing a project
- To take on the challenges of teamwork,
- To prepare a presentation in a professional manner, and document all aspects of design work.

Course Outcomes: At the end of this course, learners will be able to:

Have hands-on experience in converting a small novel idea / technique into a working model / prototype

Involving multi-disciplinary skills and / or knowledge and working in at team.

Guidelines

A multidisciplinary project to be taken up by a team of maximum of ten students. Development of prototype product, a 3D model, simulation, blueprint for a larger project and any other development work are permitted. The contribution of the individuals in the project should be clearly brought out. A combined report is to be submitted. A presentation is to be made for the reviewers on the work done by the candidate.

Learning Resources

IEEE Journal, Elsevier Journals, Springer Journals, and any open access journal, reference / user manuals, etc.

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PROFESSIONAL ELECTIVE

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-V	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX01	MEDICAL ELECTRONICS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters
- Understand the non-electrical physiological parameters and their measurement
- Study about the various assist devices used in the hospitals
- Gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.
- Understand the recent trends in medical instrumentation systems.

Course Outcomes: At the end of this course, learners will be able to:

- Know the human body electro- physiological parameters and recording of bio-potentials
- Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.
- Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators
- Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies and bio-telemetry principles and methods
- Know about recent trends in medical instrumentation

Unit I	ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING	9

Sources of bio medical signals, Bio-potentials, Bio-potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

Unit II	BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT	9

pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

Unit III	ASSIST DEVICES	9

Cardiac pacemakers, DC Defibrillator, Dialyzer, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.

Unit IV	PHYSICAL MEDICINE AND BIOTELEMETRY	9

Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.

Unit V	RECENT TRENDS IN MEDICAL INSTRUMENTATION	9

Telemedicine, Insulin Pumps, Radio pill, Endo microscopy, Brain machine interface, Lab on a chip.

TEXT BOOK(S):

1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice Hall of India, 2nd Edition, New Delhi, 2014.
2. John G.Webster, Medical Instrumentation Application and Design, 3rd Edition, Wiley India, Fifth edition, 2020.

REFERENCE(S):

1. Khandpur, R.S., Handbook of Biomedical Instrumentation, TATA McGraw-Hill, New Delhi, Third Edition, 2015.
2. Joseph J.Carr and John M.Brown, Introduction to Biomedical Equipment Technology, John Wiley and Sons, New York, 4th Edition 2001.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-V	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX02	WAVELETS AND MULTI-RESOLUTION PROCESSING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the basic elements of wavelets
- Study the multi resolution analysis
- Know the various continues wavelet transforms
- Understand the various discrete wavelet transforms
- Understand the applications of wavelets and multi-resolution processing

Course Outcomes: At the end of this course, learners will be able to:

- Introducing the basic elements of wavelets
- Explain about the multi resolution analysis
- Learning the various continues wavelet transforms
- Learning the various discrete wavelet transforms
- Understanding the applications of wavelets and multi-resolution processing

Unit I	INTRODUCTION	9

Vector Spaces - properties - dot product - basis – dimension, orthogonality and orthonormality - relationship between vectors and signals - Signal spaces – concept of Convergence - Hilbert spaces for energy signals - Generalised Fourier Expansion.

Unit II	MULTI RESOLUTION ANALYSIS	9

Definition of Multi Resolution Analysis (MRA) – Haar basis - Construction of general orthonormal MRA- Wavelet basis for MRA – Continuous time MRA interpretation for the DTWT – Discrete time MRA- Basis functions for the DTWT – PRQMF filter banks

Unit III	CONTINUOUS WAVELET TRANSFORM	9

Wavelet Transform - definition and properties - concept of scale and its relation with frequency - Continuous Wavelet Transform (CWT) - Scaling function and wavelet functions (Daubechies, Coiflet, Mexican Hat, Sinc, Gaussian, Bi-Orthogonal) – Tiling of time -scale plane for CWT.

Unit IV	DISCRETE WAVELET TRANSFORM	9

Filter Bank and sub band coding principles - Wavelet Filters - Inverse DWT computation by Filter banks - Basic Properties of Filter coefficients - Choice of wavelet function coefficients - Mallat's algorithm for DWT - Lifting Scheme: Wavelet Transform using Polyphase matrix Factorization – Geometrical foundations of lifting scheme - Lifting scheme in Z –domain

Unit V	APPLICATIONS	9

Image Compression using DWT – Sequential / Progressive - JPEG 2000 standard - Image denoising - Edge detection and object Isolation and Object Detection - Image Fusion -Wavelet Packets- Multiwavelets - Non linear wavelets – Ridgelets – Curvelets – Contourlets.

TEXT BOOK(S):

1. C. Sidney Burvus, Ramesh A.Gopinath haito, "Introduction to wavelets and wavelet Transform", Prentice Hall International, 1995.
2. Gilbert Strang, "Linear Algebra and its Applications", 3rd Edition, 2005.
3. J.C. Goswami, A.K. Chan, "Fundamentals of wavelets", John wiley and sons, 2nd Edition ,2011

REFERENCE(S):

1. Strang G, Nguyen T, "Wavelets and Filter Banks," Wellesley Cambridge Press, 2nd Edition 2009.
2. Vetterli M, Kovacevic J, "Wavelets and Sub-band Coding," Prentice Hall, 2013.
3. Mallat S., "Wavelet Signal Processing", Academic Press, , 3rd Edition 2009.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-V	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX03	ELECTRICAL AND ELECTRONICS INSTRUMENTATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Study about the measurement standards.
- Know about the indicating instruments.
- Understand the concepts of signal generation units.
- Study about the DAS and Multiplexing
- Study about the transducers.

Course Outcomes: At the end of this course, learners will be able to:

- Learning about the measurement standards.
- Explain about the indicating instruments.
- Identify the concepts of signal generation units.
- Explain about the DAS and Multiplexing
- Explain about the transducers.

Unit I	MEASUREMENT STANDARDS	7

Measurements. Significance of measurements-methods of measurements – Standards and their classification. calibration- functional elements of a measurement system - errors in measurements and statistical analysis.

Unit II	INDICATING INSTRUMENTS	10

D'ARSONAL Galvanometer- PMMC Mechanism- DC Ammeters and voltmeters- AC current and voltage measurements-RLC measurements-using ac and dc bridges-measurement of incremental inductance and low capacitances-AC voltmeters using rectifiers- digital voltmeters- Q meters-RF power and voltage measurement-high frequency measurement of inductances and capacitances.

Unit III	INSTRUMENTS FOR SIGNAL GENERATION AND ANALYSIS	9

Introduction- Sine wave generator- frequency synthesized signal generator-pulse and square wave generator-Wave analyzers-harmonic distortion analyzer-spectrum analyzer- heterodyne wave analyzer-frequency counter and time interval measurement- Block diagram of General Purpose Oscilloscope Measurement of voltage, current , phase and frequency using CRO.

Unit IV	ANALOG AND DIGITAL DATA ACQUISITION SYSTEMS	9

Components of analog and digital data acquisition systems Instrumentation Systems-Interfacing transducers to Electronic control and measuring instruments-Multiplexing-Types of multiplexing systems-Uses of data acquisition systems-Use of recorders in digital systems-Digital recording systems-Input conditioning systems-- digital data acquisition systems digital display units-segmental display-liquid crystal displays.

Unit V	TRANSDUCERS	10

Classification of transducers-Selecting a transducer- strain gauges - Temperature Transducers - Linear Variable Differential Transformer(LVDT), Advantages and Disadvantages –Capacitive Transducers, – Piezo-electric Transducers and Optoelectronic Transducers.

VIRTUAL INSTRUMENTATION: Introduction to Virtual Instrumentation – Basics of LabVIEW – FOR and WHILE loops – Structures – Arrays and Clusters – Graphs and Charts – Introduction to DAQ – Data Acquisition with LabVIEW.

TEXT BOOK(S):

1. Albert D Helfrich, Cooper. W.D, Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, New Delhi, 2009.
2. Sawhney A K, A course in Electrical and Electronic Measurement and instrumentation, Dhanpat Rai and Sons,New Delhi,19th Edition, 2016.

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REFERENCE(S):	
1.	Joseph J Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education, New Delhi, 2003.
2.	Nakra B C and Choudhury K.k., Instrumentation Measurement and Analysis, Tata McGraw Hill, New Delhi,4th Edition, 2017.
3.	Jovitha Jerome, Virtual Instrumentation Using LabView, Prentice Hall of India, New Delhi, 2013.
4.	Garry M Johnson,Lab View Graphical Programming, Tata McGraw Hill, New Delhi, 2011.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-V	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX04	ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the basic principles of EMI
- Study the various types of EMI coupling principles
- Know the various aspects EMI/EMC coupling
- Understand the suitable EMI testing and controlling techniques
- Know about the EMC design of PCBs

Course Outcomes: At the end of this course, learners will be able to:

- Learn the basic principles of EMI
- Learn the various types of EMI coupling principles
- Formulate the various aspects EMI/EMC coupling
- Identify a suitable EMI testing and controlling techniques
- Develop the EMC design of PCBs

Unit I	EMI ENVIRONMENT	9

EMI/EMC concepts and definitions, Sources of EMI, conducted and radiated EMI, Transient EMI, Time domain Vs Frequency domain EMI, Units of measurement parameters, Emission and immunity concepts, ESD

Unit II	EMI COUPLING PRINCIPLES	9

Conducted, Radiated and Transient Coupling, Common Impedance Ground Coupling, Radiated Common Mode and Ground Loop Coupling, Radiated Differential Mode Coupling, Near Field Cable to Cable Coupling, Power Mains and Power Supply coupling

Unit III	EMI/EMC STANDARDS AND MEASUREMENTS	9

Civilian standards - FCC, CISPR,I EC, EN, Military standards - MIL STD 461D/462, EMI Test Instruments /Systems, EMI Shielded Chamber, Open Area Test Site, TEM Cell, Sensors/Injectors/Couplers, Test beds for ESD and EFT, Military Test Method and Procedures

Unit IV	EMI CONTROL TECHNIQUES	9

Shielding, Filtering, Grounding, Bonding, Isolation Transformer, Transient Suppressors, Cable Routing, Signal Control, Component Selection and Mounting

Unit V	EMC design of PCBs	9

PCB Traces Cross Talk, Impedance Control, Power Distribution Decoupling, Zoning, Motherboard Designs and Propagation Delay Performance Models

REFERENCE(S):

1. Ott, Henry W., "Noise Reduction Techniques in Electronic Systems", John Wiley & Sons, New York, 1998
2. Paul, C.R., "Introduction to Electromagnetic Compatibility", John Wiley & Sons, New York, 2006.
3. Kodali, V.P., "Engineering EMC Principles, Measurements and Technologies", IEEE Press, London, 1996.
4. Keiser, Bernhard., "Principles of Electromagnetic Compatibility", Third Edition, Artech House, Dedham, 1986.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-V	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX05	SPEECH PROCESSING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Study the various digital models of speech signal
- Know the different methods for speech processing
- Understand the mathematical tools to speech
- Understand the speech coding techniques
- Know the various speech parameters with appropriate techniques

Course Outcomes: At the end of this course, learners will be able to:

- Discuss various digital models of speech signal
- Illustrate different methods for speech processing
- Apply mathematical tools to speech
- Explain speech coding techniques
- Discuss various speech parameters with appropriate techniques

Unit I	DIGITAL MODELS FOR SPEECH SIGNAL	9

Process and of speech production - Acoustic theory of speech production – Digital models for speech signals.

Unit II	TIME DOMAIN METHODS FOR SPEECH PROCESSING	9

Time domain parameters of speech, methods for extracting the parameters, Zero crossings, Auto correlation function, pitch estimation.

Unit III	FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING	9

Short time Fourier analysis, filter bank analysis, spectrographic analysis, Formant extraction, pitch extraction, Analysis - synthesis systems.

Unit IV	LINEAR PREDICTIVE CODING OF SPEECH	9

Formulation of linear prediction problem in time domain, solution of LPC equations, Interpretation of linear prediction in auto correlation and spectral domains.

Unit V	SPEECH ANALYSIS AND SYNTHESIS	9

Cepstral analysis of speech, formant and pitch estimation, Applications of speech processing - Speech recognition, Speech synthesis and speaker verification.

TEXT BOOK(S):

1. L.R. Rabiner and R.E Schafer, Digital processing of speech signals, Dorling Kindersley (India) Pvt. Ltd, 2005.

REFERENCE(S):

1. L.R. Rabiner and Biling Hwang Juang, Fundamentals of Speech recognition, Pearson Education,2nd Edition ,2005.
2. J.L Flanagan, Speech Analysis Synthesis and Perception - 2nd Edition - Springer Verlag, 1983.
3. I.H.Witten, Principles of Computer Speech, Academic press, 1985.
4. Thomas F. Quateri, Discrete-Time Speech Processing Principles and Practice, Pearson Education, 2006.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-VI	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ECX06	WIRELESS ADHOC AND SENSOR NETWORKS	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Understand the various routing protocols of Adhoc networks
- Know the architecture of wireless sensor networks
- Know the protocols of wireless sensor networks
- Understand the sensor network security concepts
- Study about sensor network platforms and tools

Course Outcomes: At the end of this course, learners will be able to:

- Analyze various routing protocols of Adhoc networks
- Describe the architecture of wireless sensor networks
- Analyze the protocols of wireless sensor networks
- Analyze the sensor network security concepts
- Discuss the sensor network platforms and tools

Unit I	INTRODUCTION	9

Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) :concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

Unit II	MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS	9

Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols- Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11

Unit III	ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS	9

Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (on-demand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

Unit IV	WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS	9

Single node architecture: hardware and software components of a sensor node - WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

Unit V	WSN ROUTING, LOCALIZATION & QOS	9

Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.

TEXT BOOK(S):

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2012.
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal "Ad Hoc & Sensor Networks: Theory and Applications", World Scientific Publishing Company,2nd Edition, 2011.

REFERENCE(S):

1. Feng Zhao, Leonidas Guibas, Wireless Sensor Networks: an information processing approach, Elsevier publication, 2008.
2. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley, 2007.
3. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VI	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX07	HIGH SPEED NETWORKS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Know about the various broadband networking algorithms
- Study about the queuing algorithms for high performance networks
- Understand the congestion control algorithms in high speed networks
- Understand the concepts of various networking services supporting high speed communication
- Know the various protocols in high speed networks for maintaining QoS

Course Outcomes: At the end of this course, learners will be able to:

- Evaluate various broadband networking algorithms
- Design queuing algorithms for high performance networks
- Analyze the congestion control algorithms in high speed networks
- Analyze the concepts of various networking services supporting high speed communication
- Apply various protocols in high speed networks for maintaining QoS

Unit I	HIGH SPEED NETWORKS	9

Frame relay networks – Asynchronous Transfer Mode (ATM) – ATM protocol architecture, ATM logical connection, ATM cell – ATM service categories – AAL High Speed LANs: Fast Ethernet- Gigabit ethernet.

Unit II	CONGESTION AND TRAFFIC MANAGEMENT	9

Queuing analysis- Queuing models – Single server queues – Effects of congestion – Congestion control – Traffic management – Congestion control in packet switching networks – Frame relay congestion control.

Unit III	TCP AND ATM CONGESTION CONTROL	9

TCP flow control – TCP congestion control – Retransmission – Timer management – Exponential RTO backoff – KARN's algorithm – Window management – Performance of TCP over ATM - Traffic and congestion control in ATM – Requirements.

Unit IV	INTEGRATED AND DIFFERENTIATED SERVICES	9

Integrated services architecture – Approach, components, services- Queuing discipline – Random early detection (RED) - Differentiated services.

Unit V	PROTOCOLS FOR QOS SUPPORT	9

RSVP – Goals & characteristics - Data flow - RSVP operations - Protocol mechanisms – Multiprotocol Label Switching – Operations - Label stacking - Protocol details – RTP – Protocol architecture - Data transfer protocol - RTCP.

TEXT BOOK(S):

1. William Stallings, "High-speed networks and internets: performance and quality of service", 2nd Edition, Pearson Education India, 2010.

REFERENCE(S):

1. Walrand Jean and Varaiya Pravin., High Performance Communication Networks, 2nd Edition, Harcourt Asia Pvt. Ltd., Singapore, 2001.
2. PepelnjkIrvan, Guichard Jim and Apcar Jeff, MPLS and VPN Architecture, Volume I & II, 1st Edition, Cisco Press, London, 2014.
3. William Stallings, "High-speed networks: TCP/IP and ATM Design Principles", 2nd Edition, Pearson Education, 1998.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VI	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX08	MACHINE LEARNING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the basic concepts of machine learning
- Know about the various types of neural networks and genetic algorithms
- Study about bayesian and computational learning
- Understand instant based learning
- Know about various advanced learning concepts

Course Outcomes: At the end of this course, learners will be able to:

- Explain the basic concepts of machine learning
- Explain about the various types of neural networks and genetic algorithms
- Identify the concepts of bayesian and computational learning
- Explain about instant based learning
- Identify the various advanced learning concepts

Unit I	INTRODUCTION	9

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

Unit II	NEURAL NETWORKS AND GENETIC ALGORITHMS	9

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evaluation and Learning

Unit III	BAYESIAN AND COMPUTATIONAL LEARNING	9

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

Unit IV	INSTANT BASED LEARNING	9

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning.

Unit V	ADVANCED LEARNING	9

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

REFERENCE(S):

1. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press,4th Edition, 2020.
2. Stephen Marsland, Machine Learning: An Algorithmic Perspective, CRC Press, 2015

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Department	ELECTRONICS AND COMMUNICAYION ENGINEERING				R 2019	Semester-VI	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ECX09	ARTIFICIAL INTELLIGENCE	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Study about the AI-Problem formulation and Measure of performance and analysis
- Understand knowledge representation using predicate logic and structured.
- Know about knowledge based systems and frame based inference.
- Understand advanced plan generation systems.
- Study about the expert system.

Course Outcomes: At the end of this course, learners will be able to:

- Explain the AI-Problem formulation and Measure of performance and analysis
- Analyze the knowledge representation using predicate logic and structured.
- Identify the knowledge based systems and frame based inference.
- Explain about the advanced plan generation systems.
- Identify about the expert system..

Unit I	INTRODUCTION TO AI AND PRODUCTION SYSTEMS	9

Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized production system- Problem solving methods – Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction – Related algorithms, Measure of performance and analysis of search algorithms.

Unit II	REPRESENTATION OF KNOWLEDGE	9

Game playing – Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

Unit III	KNOWLEDGE INFERENCE	9

Knowledge representation -Production based system, Frame based system. Inference – Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning – Certainty factors, Bayesian Theory-Bayesian Network-Dempster – Shafer theory.

Unit IV	PLANNING AND MACHINE LEARNING	9

Basic plan generation systems – Strips -Advanced plan generation systems – K strips -Strategic explanations -Why, Why not and how explanations. Learning- Machine learning, adaptive Learning.

Unit V	EXPERT SYSTEMS	9

Expert systems – Architecture of expert systems, Roles of expert systems – Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN, DART, XOON, Expert systems shells.

TEXT BOOK(S):	
1.	Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill- 2008.
2.	Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.
REFERENCE(S):	
1.	Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2003.
2.	Stuart Russel and Peter Norvig "AI – A Modern Approach", 4th Edition, Pearson Education 2020.
3.	Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education 2013

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester- VI	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX10	WIRELESS NETWORKS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the Bluetooth link types and Zig-Bee technology
- Study about WLAN technologies and layers.
- Understand GSM evolution for data and Layering structures.
- Know about TCP enhancements for wireless networks
- Understand about 4G features and challenges.

Course Outcomes: At the end of this course, learners will be able to:

- Identify the Bluetooth link types and Zig-Bee technology
- Explain about WLAN technologies and layers.
- Analyze the GSM evolution for data and Layering structures.
- Explain about TCP enhancements for wireless networks
- Identify the 4G features and challenges.

Unit I	WIRELESS PERSONAL AREA NETWORK (WPAN)	9

IEEE 802.15.1(Bluetooth): Protocol stack- Bluetooth link types, Bluetooth network connection establishment. IEEE 802.15.3 (WPAN-LR): Wireless sensor network model- 802.15.3-Protocol stack- Device architecture- ZigBee technology. IEEE 802.15.3a (WPAN-HR): Ultra wide band

Unit II	WIRELESS LOCAL AREA NETWORK (WLAN)	9

WLAN technologies and topologies- IEEE 802.11 architecture- Physical layer- Data link layer-MAC layer - MAC sub layer- Power management- 802.11 b/n. HIPERLAN- Multimedia access communication, Co-existence (Bluetooth and WLAN)- IEEE 802.16 - WiMAX : Physical layer- Media access control- Spectrum allocation

Unit III	WIRELESS WIDE AREA NETWORKS	9

GSM: GSM evolution for data - High speed circuit switched data- Enhanced data rates for GSM enhancement- General packet radio service - CDMA 2000: Layering structure - Forward and reverse Link

Unit IV	MOBILE NETWORK AND TRANSPORT LAYER	9

Wireless TCP: Wireless TCP/IP - Network layer in internet - TCP enhancements for wireless networks - Wireless TCP implementation-Mobile IP – SIP - WAP – Model and architecture

Unit V	4G NETWORKS	9

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.

TEXT BOOK(S):

1. Vijay K. Garg, "Wireless Communications and Networking", 1st Edition, Morgan Kaufmann Publishers, 2007.

REFERENCE(S):

1. Kaveh Pahlavan, Prashant Krishnamurthy, "Principles of Wireless Networks", 1st Edition, Pearson Education Asia, 2013
2. Gary. S. Rogers & John Edwards, An Introduction to Wireless Technology, 2nd Edition, Pearson Education, 2003.
3. Clint Smith, P.E. & Daniel Collins, 3G Wireless Networks, 2nd Edition, McGraw Hill, 2007.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX11	DATA COMPRESSION TECHNIQUES	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Know the basics of data compression
- Understand the efficiency of various text compression algorithms in terms of speed and compression ratio
- Know the types of speech and audio techniques
- Study about the different compression techniques and standards for image
- Know about the various video compression standards

Course Outcomes: At the end of this course, learners will be able to:

- Describe the basics of data compression
- Calculate the efficiency of various text compression algorithms in terms of speed and compression ratio
- Examine the types of speech and audio techniques
- Analyze different compression techniques and standards for image
- Compare various video compression standards

Unit I	INTRODUCTION	9

Multimedia data - Features — Storage requirements for multimedia - Need for Compression - Taxonomy of compression – Metrics – Quantitative and Qualitative techniques - Overview of source coding – Vector quantization.

Unit II	TEXT COMPRESSION	9

Characteristics of text data – Run Length Encoding - Huffmann coding – Adaptive Huffmann Coding – Arithmetic coding — Dictionary techniques – LZW algorithm - GIF, TIF, JBIG, JBIG2.

Unit III	AUDIO AND SPEECH COMPRESSION	9

Fundamental concepts of speech and audio - Audio compression techniques – μ Law and A- Law companding - PCM, DPCM, DM, ADM - sub-band coding – Application to speech coding – G.722 – MPEG audio – MP3, MP4 - LPC – CELP , RELP coders.

Unit IV	IMAGE COMPRESSION	9

Image data representation – Transform Coding – DCT - JPEG Standard – Fundamentals of Wavelets – Properties – Multi Resolution Analysis - DWT – Sub-band coding – QMF Filters – JPEG 2000 standard.

UNIT V	VIDEO COMPRESSION	9

Fundamental concepts of video – Digital video signal - Video signal representation - Motion estimation and compensation Techniques –Block based motion estimation – MPEG Video Compression standards: MPEG – 1, 2 and 4 H.264 Standard.

TEXT BOOK(S):

1. Khalid Sayood, "Introduction to Data Compression", Morgan Kauffman Harcourt India, 5th Edition, 2018.

REFERENCE(S):

1. David Salomon, Data Compression The Complete Reference, Springer Verlag New York Inc.,2nd Edition, 2007.
2. Mark S. Drew, Ze-Nian Li, Jiangchuan Liu, Fundamentals of Multimedia, Prentice Hall of India, 2nd Edition, 2016.
3. Yun Q.Shi, Huifang Sun, Image and Video Compression for Multimedia Engineering - Fundamentals, Algorithms & Standards, CRC press,3rd Edition, 2019
4. Peter Symes , Digital Video Compression, McGraw Hill Pub., 2004.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX12	VIDEO ANALYTICS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the need for video Analytics and their components.
- Know the basic configuration of fore ground extraction and morphological operation.
- Know the various types of classifiers and filters.
- Understand the functional blocks of a video analytic system for security
- Know the various applications of video analytics for business applications.

Course Outcomes: At the end of this course, learners will be able to:

- Explain the need for video Analytics and their components.
- Identify the basic configuration of fore ground extraction and morphological operation.
- Explain the various types of classifiers and filters.
- Identify the functional blocks of a video analytic system for security
- Explain the various applications of video analytics for business applications.

Unit I	VIDEO ANALYTIC COMPONENTS	9

Need for Video Analytics-Overview of video Analytics- Foreground extraction- Feature extraction- classifier - Preprocessing- edge detection- smoothening- Feature space-PCA-FLD-SIFT features

Unit II	FOREGROUND EXTRACTION	9

Background estimation- Averaging- Gaussian Mixture Model- Optical Flow based- Image Segmentation- Region growing- Region splitting-Morphological operations- erosion-Dilation- Tracking in a multiple camera environment

Unit III	CLASSIFIERS	9

Neural networks (back propagation) - Deep learning networks- Fuzzy Classifier- Bayesian classifier- HMM based classifier

Unit IV	VIDEO ANALYTICS FOR SECURITY	9

Abandoned object detection- human behavioral analysis -human action recognition- perimeter security- crowd analysis and prediction of crowd congestion

Unit V	VIDEO ANALYTICS FOR BUSINESS INTELLIGENCE & TRAFFIC MONITORING AND ASSISTANCE	9

Customer behavior analysis - people counting- Traffic rule violation detection- traffic congestion identification for route planning- driver assistance- lane change warning

TEXT BOOK(S):

1. Graeme A. Jones, Nikos Paragios, Carlo S. Regazzoni Video-Based Surveillance Systems: Computer Vision and Distributed Processing , Kluwer academic publisher, 2002
2. Nilanjan Dey, Amira Ashour and Suvojit Acharjee, Applied Video Processing in Surveillance and Monitoring Systems (IGI global), 2017.

REFERENCE(S):

1. Zhihao Chen, Ye Yang , Jingyu Xue, Liping Ye, Feng Guo, The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite, Create Space Independent Publishing Platform, 2014
2. Caifeng Shan, Fatih Porikli, Tao Xiang, Shaogang Gong , Video Analytics for Business Intelligence, Springer, 2012

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Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX13	DIGITAL IMAGE PROCESSING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the digital image fundamentals
- Know the methodology for smoothening and sharpening of the image.
- Study the method to restore the image and object recognition
- Learn the image segmentation using edge detection, thresholding and region based approach.
- Know to Compress the image using lossy and lossless compression techniques.

Course Outcomes: At the end of this course, learners will be able to:

- Analyze the image using image transforms.
- Develop a methodology for smoothening and sharpening of the image.
- Develop a method to restore the image and object recognition
- Segment the image using edge detection, thresholding and region based approach.
- Compress the image using lossy and lossless compression techniques.

Unit I	DIGITAL IMAGE FUNDAMENTALS	9

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

Unit II	IMAGE ENHANCEMENT	9

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

Unit III	IMAGE RESTORATION	9

Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering

Unit IV	IMAGE SEGMENTATION	9

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm.

Unit V	IMAGE COMPRESSION AND RECOGNITION	9

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes- Recognition based on matching.

TEXT BOOK(S):

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, Pearson, Fourth Edition, 2018.
2. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson, 2006.

REFERENCE(S):

1. Kenneth R. Castleman, Digital Image Processing, Pearson, Reprint,2008
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB, Pearson Education, Inc., 3RD Edition,2020.
3. D,E. Dudgeon and RM. Mersereau, Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, Digital Image Processing, John Wiley, New York, 2014.

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Department	ELECTRONICS AND COMMUNICAYION ENGINEERING				R 2019	Semester-VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ECX14	BIOMEDICAL IMAGE PROCESSING	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Understand the basic concepts of acquisition of images.
- Study the origins of three dimensional Image Reconstructions.
- Understand Sources of reconstruction algorithms and scan motions.
- Understand use of Pulse techniques, motion suppression techniques.
- Know the System components and Limitations of Doppler systems.

Course Outcomes: At the end of this course, learners will be able to:

- Explain the basic concepts of acquisition of images.
- Know the origins of three dimensional Image Reconstructions.
- Explain the Sources of reconstruction algorithms and scan motions.
- Identify the use of Pulse techniques, motion suppression techniques.
- Explain the System components and Limitations of Doppler systems.

Unit I	ACQUISITION OF IMAGES	9

Introduction to Imaging Techniques - Single crystal scintillation camera - Principles of scintillation camera - multiple crystal scintillation camera - solid state camera - rectilinear scanner- Emission computed Tomography.

Unit II	MATHEMATICAL PRELIMINARIES FOR IMAGE RECONSTRUCTION	9

Image Reconstruction from Projections in Two dimensions- Mathematical Preliminaries for Two and Three dimensional Image Reconstructions - Radon Transform- Projection Theorem - central slice Theorem- Sinogram- Two Dimensional Projection Reconstruction- Three Dimensional Projection Reconstruction- Iterative Reconstruction Techniques.

Unit III	FLUOROSCOPY, CT, IMAGE QUALITY	9

Digital fluoroscopy- Automatic Brightness control - cinefluorography- Principles of computed Tomographic Imaging - Reconstruction algorithms - Scan motions- X-ray sources. Influences of Images quality: Unsharpness- contrast - Image Noise.

Unit IV	MAGNETIC RESONANCE IMAGING AND SPECTROSCOPY	9

Fundamentals of magnetic resonance- overview -Pulse techniques- spatial encoding of magnetic resonance imaging signal- motion suppression techniques- contrast agents- tissue contrast in MRI- MR angiography, spectrography.

Unit V	ULTRASOUND, NEUROMAGNETIC IMAGING	9

Ultrasound: Presentation modes- Time required to obtain Images- System components, signal processingdynamic Range- Ultrasound Image Artifacts- Quality control, Origin of Doppler shift- Limitations of Doppler systems. Neuromagnetic Imaging: Background.

TEXT BOOK(S):

1. William R. Hendee, E. Russe Ritenour "Medical Imaging Physics", A John Wiley & sons, Inc., Publication, Fourth Edition 2002.
2. Z.H. Cho., J-oie, P. Jones and Manbir Singh, Foundations of Medical Imaging: John Wiley and sons Inc,1993

REFERENCE(S):

1. Avinash C. Kak, Malcolm Shaney, "Principles of Computerized Tomographic Imaging", IEEE Press, Newyork-2007.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX15	STATISTICAL SIGNAL PROCESSING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Learn the concepts of discrete time random process
- Understand the knowledge in spectrum estimation and analysis
- Learn various types of linear prediction
- Study about the adaptive filter
- Study the basic knowledge on speech processing

Course Outcomes: At the end of this course, learners will be able to:

- Explain the basic concepts of discrete time random process
- Gain the knowledge in spectrum estimation and analysis
- Know the various types of linear prediction
- explain about the adaptive filter
- know the basic concepts of speech processing

Unit I	DISCRETE RANDOM SIGNAL PROCESSING	9

Discrete time random process – Random process: Ensemble averages- Gaussian process – stationary process – The auto-covariance and autocorrelation matrices – ergodicity – white noise the power spectrum. Filtering random process – spectral factorization. Parseval's theorem – Wiener Khintchine relation.

Unit II	SPECTRUM ESTIMATION AND ANALYSIS	9

Non parametric methods: Periodogram, performance of periodogram, modified periodogram, Bartlett's method, Welch's method. Parametric methods: AR model – Yule-Walker method, MA model – ARMA model.

Unit III	LINEAR PREDICTION	9

Forward and backward linear predictions, Solution of the normal equations – Levinson-Durbin algorithms. Least mean squared error criterion – The FIR Wiener filter – filtering – linear prediction and The IIR Wiener filters – Non causal IIR Wiener filter – the causal IIR Wiener filter.

Unit IV	ADAPTIVE FILTER	9

Concepts of adaptive filter – FIR adaptive filters – LMS algorithm – Applications: Noise cancellation- Adaptive recursive filers– AR lattice structure and ARMA process, lattice – ladder filters.

Unit V	OVERVIEW OF SPEECH PROCESSING	9

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Short time Homomorphic Filtering of Speech; Linear Prediction (LP) analysis: Basis and development, LPC spectrum.

REFERENCE(S):

1. Hayes, Monson H. "Statistical Digital Signal processing and Modeling", John Wiley and Sons, Inc., 2014
2. Proakis, John G. and Manolakis, Dimitris G. "Digital Signal Processing: Principles Algorithms and Applications", PHI, 2007
3. Ifeachor, Emmanuel C. and Jervis, Barrie N. "Digital Signal Processing: A Practical Approach", Addison-Wesley Publishing Company, 2002.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ECX16	CAD FOR VLSI CIRCUITS	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Learn the design methodologies
- Gain the knowledge on Partitioning, Placement and Floor planning
- Study the routing and compaction
- Study the logic simulation
- Understand the logic synthesis

Course Outcomes: At the end of this course, learners will be able to:

- Explain the design methodologies
- Gain the knowledge on Partitioning, Placement and Floor planning
- Explain the routing and compaction
- Gain the knowledge of logic simulation
- Explain the logic synthesis and Assignment problem

Unit I	DESIGN METHODOLOGIES	9

Introduction to VLSI Design methodologies – Review of VLSI Design automation tools –Algorithmic Graph Theory and Computational Complexity –Tractable and Intractable problems – general purpose methods for combinatorial optimization problems

Unit II	PARTITIONING, PLACEMENT AND FLOOR PLANNING	9

Placement and Partitioning –Circuit representation –Placement algorithms – Partitioning- Partitioning algorithms-Floor planning concepts –shape functions and floor plan sizing –Floor planning based on Simulated Annealing.

Unit III	ROUTING AND COMPACTION	9

Routing – Types of local routing problems – Area routing – channel routing – global routing –algorithms for global routing. Compaction- Layout Compaction –Design rules –problem formulation –algorithms for constraint graph compaction.

Unit IV	LOGIC SIMULATION	9

Simulation –Gate-level modeling and simulation –Switch-level modeling and simulation Combinational Logic Synthesis –Binary Decision Diagrams –ROBDD

Unit V	LOGIC SYNTHESIS	9

Two Level Logic Synthesis. High level Synthesis –Hardware models –Internal representation Allocation assignment and scheduling –Simple scheduling algorithm –Assignment problem –High level transformations.

REFERENCE(S):

1. Gerez, S.H., "Algorithms for VLSI Design Automation", John Wiley & Sons, New York, 2005
2. Sherwani, N.A., "Algorithms for VLSI Physical Design Automation", Kluwar Academic Publishers, Boston, 2012
3. Sarafzadeh, C.K. Wong, "An Introduction to VLSI Physical Design", Mc Graw Hill International Edition 1996
4. Hill, D., Shugard, D., Fishburn, J. and Keutzer, K., "Algorithms and Techniques for VLSI Layout Synthesis", Kluwer Academic Publishers, Boston, 2000
5. Drechsler, R., "Evolutionary Algorithms for VLSI CAD", Kluwer Academic Publishers, Boston, 2011

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ECX17	SYSTEM ON CHIP	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Understand the structure and operation of systems-on-chip
- Study the concepts of IP core design process
- Know the concepts involved in Processors and Memories
- Understand the SOC Interconnects and Interfaces
- Learn the validation and verification of the SOC applications

Course Outcomes: At the end of this course, learners will be able to:

- Illustrate the system-on-chip design process
- Demonstrate IP core design process
- Explain the concepts involved in Processors and Memories
- Analyze SOC Interconnects and Interfaces
- Validate and Verify the SOC applications

Unit I	SYSTEM ON CHIP DESIGN PROCESS	9

Technology Challenges - SoC Technology - Verification Technology Options - Architecture of the present day SoC- Canonical SoC Design - SoC Design Flow - Waterfall - Spiral SoC Design Flow - Hardware-Software Codesign flow- Top Down & Bottom up Design Methodology – Specification requirement, Types of Specification , System Design process, System level design issues, Design for timing closure, Logic design issues - Low Power - EDA Tools and Vendors

Unit II	IP CORE/ MACRO DESIGN PROCESS	9

Overview of IP Designs- Overview of Design Process- Planning and Specification - Soft IP Vs Hard IP Macro Design Process- Soft - Design Issues - Design Process - Hard Macro Productization – Integrating Blocks into chip

Unit III	PROCESSOR AND MEMORIES	9

Processor: Processor Selection for SoC - Basic Concept of Processor Architecture - Pipeling – Parallel Processing - VLIW Processor - Superscalar Processor - ARM Micro architecture Memories :Outline of Memory Design - Memory Technology -Cache Memory Basics - SOC (On-Die) -Memory System - Board Based (Off- Die) Memory System - 3T & 1T DRAM Memory Cell, 6T SRAM Memory Cell, PROM, eDRAM , Flash Memory Cell - DRAM Memory Array - SDRAM - DDR SDRAM – Memory compiler

Unit IV	SOC SUBSYSTEM INTERCONNECTS AND INTERFACES	9

Interconnect Architectures- Bus Basic Architecture - SOC System Level Standard Interconnect Busses- ARM AMBA, AXI- Altera Avalon -IBM Core Connect- Silicore WISHBONE- PC Based Interconnects: Ethernet- PCI - USB -E-SATA, SPI - I2C- JTAG - SoC Interconnect Switches- Interfaces: UART – VGA – HDMI

Unit V	SOC VALIDATION, VERIFICATION AND APPLICATION	9

Core Validation Flow - Test Bench – Co Simulation - Emulation - Prototype - Verification architecture, Verification components, Introduction to VMM, OVM and UVM - Applications : Approach for designing SOC Devices - Bluetooth SOC - AES - 3D Graphics Processor - Trimedia Processor- Image Compression - Video Compression -MP3 Audio Decoding - Software Defined Radio (SDR) with 802.16

REFERENCE(S):

1. Michael J. Flynn, Wayne Luk, Computer System Design: System- on-Chip, Wiley,2013.
2. Prakash Raslinkar, Peter Paterson & Leena Singh, System-on-a-chip verification: Methodology And echniques, Kluwer Academic Publishers, 2000.
3. Michael Keating, Pierre Bricaud, Reuse Methodology Manual for System- on- a- Chip Designs,Third Edition Kluwer Academic Publishers, 2002
4. Rochit Rajsuman, System-on-a-chip: Design and Test, Artech House, 2007

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ECX18	DESIGN AND ANALYSIS OF DIGITAL INTEGRATED CIRCUITS	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Learn the concepts on deep submicron digital IC design
- Understand the MOS inverter circuits, static MOS gate circuits
- Understand various types of high speed CMOS logic designs
- Know the concepts of semiconductor memory and interconnect design
- Study about power grid and clock design

Course Outcomes: At the end of this course, learners will be able to:

- Gain the concepts on deep submicron digital IC design
- Design the MOS inverter circuits, static MOS gate circuits
- Explain the various types of high speed CMOS logic designs
- Impart the knowledge in semiconductor memory and interconnect design
- Explain about power grid and clock design

Unit I	DEEP SUBMICRON DIGITAL IC DESIGN	9

Review of Digital Logic Gate Design-digital IC design-computer Aided Design of digital circuits-The MOS Transistor-Bipolar Transistor and circuits-IC Fabrication technology-Layout basics-SOI technology

Unit II	MOS INVERTER CIRCUITS, STATIC MOS GATE CIRCUITS	9

Voltage transfer characteristics-noise margin definitions-resistive load inverter design-NMOS transistors as load devices-CMOS inverter-pseudo-NMOS inverters-sizing inverters- tristate inverters-CMOS gate circuits-complex CMOS gates-XOR and XNOR gates-multiplexer circuits – Flip-flops and latches – D flip-flops and latches – power dissipation in CMOS gates-power and delay trade-offs

Unit III	HIGH SPEED CMOS LOGIC DESIGN, TRANSFER GATE AND DYNAMIC LOGIC DESIGN	9

Switching time analysis – detailed load capacitance calculation – improving delay calculation with input slope - gate sizing for optimal path delay – optimizing path with logical effort – basic concepts of transfer gate – CMOS transmission gate logic – dynamic D latches and D flip-flops – domino logic –voltage bootstrapping

Unit IV	SEMICONDUCTOR MEMORY AND INTERCONNECT DESIGN	9

Introduction-MOS decoders – static RAM cell design-SRAM column I/O circuitry – memory architecture-content addressable memories-FPGA-dynamic Read-Write memories-Read Only memories-EPROMs and EEPROMs-flash memory-FRAMs-interconnect RC delays-buffer insertion for very long wires-interconnect coupling capacitance-interconnect inductance-antenna effects.

Unit V	POWER GRID AND CLOCK DESIGN	9

Power distribution design-clocking and timing issues, phase-locked loops/delay-locked loops

REFERENCE(S):

1. Hodges, David A, Jackson, Horace G, and Saleh, Resve A., "Analysis and Design of Digital Integrated Circuits: in deep submicron technology", Tata McGraw-Hill, New Delhi, 2005.
2. Sung-Mo Kang, and Yusuf Leblebici, "CMOS Digital Integrated Circuits: Analysis and design", Third Edition, Tata McGraw Hill, New Delhi, 2015.
3. Rabaey, Jan M, Chandrakasan, Anantha, and Borivoje Nikolic, "Digital Integrated Circuits", Second Edition, Printice Hall Inc, New Jersey,2nd Edition, 2016

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX19	LOW POWER VLSI	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the sources of power dissipation in CMOS logic design.
- Understand the low power design and optimization techniques.
- Gain the power at different levels.
- Study about the leakage reduction techniques.
- Understand the effect of capacitance on power reduction.

Course Outcomes: At the end of this course, learners will be able to:

- Discuss the sources of power dissipation in CMOS logic design.
- Illustrate low power design and optimization techniques.
- Estimate power at different levels.
- Examine leakage reduction techniques.
- Discuss effect of capacitance on power reduction.

Unit I	POWER DISSIPATION IN CMOS	9

Need for low power design, Hierarchy of limits of power – Sources of power consumption – Basic principle of low power design, Degree of freedom.

Unit II	SUPPLY VOLTAGE SCALING	9

Challenges in supply voltage scaling, Voltage scaling approaches, Static voltage scaling approaches- Device feature size scaling, Architectural level approaches - Parallelism, Pipelining, voltage scaling through optimal transistor sizing, voltage scaling using high level transformations, multi level voltage scaling, Dynamic voltage scaling, Adaptive voltage scaling.

Unit III	SWITCHED CAPACITANCE MINIMIZATION	9

Hardware Software Trade-off, Bus Encoding, Use of number system, Architectural level Optimization Techniques, Glitch power, Clock Gating, State encoding, Logic styles, Low power techniques for SRAM and DRAM. Special topics - Adiabatic Switching Circuits Battery-aware Synthesis Variation tolerant design CAD tools for low power synthesis.

Unit IV	LEAKAGE POWER MINIMIZATION	9

Standby leakage reduction- Fabrication of multiple threshold voltages, Transistor stacking, Variable-threshold-voltage CMOS (VTCMOS), Multi-threshold-voltage CMOS (MTCMOS), Power gating, Run time leakage reduction- VDD scaling, combining power gating with Dynamic voltage and frequency scaling, multi level VDD scaling, Dual-Vt assignment approach (DTCMOS), dynamic Vth scaling.

Unit V	POWER ESTIMATION	9

Power estimation techniques – Logic level power estimation – Simulation power analysis– Probabilistic power analysis.

TEXT BOOK(S):

1. K.Roy and S.C. Prasad , Low Power CMOS VLSI circuit design, Wiley,2000

REFERENCE(S):

1. Gary Yeap, Practical low power digital VLSI design, Kluwer, 2012.
2. Dimitrios Soudris, Chirstian Pignet, Costas Goutis, Designing CMOS Circuits For Low Power,Kluwer,2002
3. J.B. Kuo and J.H Lou, Low voltage CMOS VLSI Circuits, Wiley 1999.
4. A.P.Chandrakasan and R.W. Broadersen, Low power digital CMOS design, Kluwer, 1998.
5. Abdellatif Bellaouar, Mohamed.I. Elmasry, Low power digital VLSI Design, Kluwer, 2012
6. James B. Kuo, Shin chia Lin, Low voltage SOI CMOS VLSI Devices and Circuits, John Wiley and sons, inc 2010

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX20	TESTING OF VLSI CIRCUITS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Study the various fault models and fault simulation techniques
- Understand the faults in combinational and sequential logic circuits
- Study the various methods for delay tests
- Know the different testability methods
- Understand fault diagnosis approaches

Course Outcomes: At the end of this course, learners will be able to:

- Explain the various fault models and fault simulation techniques
- Examine faults in combinational and sequential logic circuits
- Gain the knowledge of various methods for delay tests
- Explain different testability methods
- Outline fault diagnosis approaches

Unit I	FAULT MODELING AND SIMULATION	9

Importance of Testing-Testing during the VLSI Lifecycle- Fault models- Levels of abstraction in VLSI testing-Simulation models- Logic Simulation-Fault Simulation

Unit II	DESIGN FOR TESTABILITY	9

Testability analysis –DFT Basics- Scan Cell Designs- Scan Architectures- Scan Design Rules- Scan Design Flow- RTL Design for Testability.

Unit III	TEST GENERATION	9

Random Test Generation- Designing a Stuck-at ATPG for Combinational Circuits- Designing a Sequential ATPG- Untestable Fault Identification- Designing Simulation based ATPG-Hybrid Deterministic and Simulation based ATPG- ATPG for Non-Stuck at Faults

Unit IV	BUILT IN SELF TEST	9

BIST Design rules- Test Pattern generation- Output Response Analysis- Logic BIST Architecture- Fault Coverage Enhancement- BIST Timing Control- Logic BIST System Design

Unit V	LOGIC DIAGNOSIS AND MEMORY TESTING	9

Combinational Logic Diagnosis- Scan Chain Diagnosis- Logic BIST Diagnosis- RAM functional Fault Models and Test Algorithms- RAM Fault Simulation and Test Algorithm Generation

REFERENCE(S):

1. Laung Terng wang, Cheng wen wu, Xidogingwen, "VLSI Testing Principles and Architectures: Design for Testability", Morgan Kaufmann Publisher, 2006
2. Abramovici, M., Breuer, M.A and Friedman, A.D., "Digital Systems and Testable Design", Jaico Publishing House, 2015.
3. Bushnell, M.L and. Agrawal, V.D., "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwar Academic Publishers, 2010
4. Nilcolici Nicoda, Al- HAshmini, "Power constrained Testing of VLSI Circuits", Kluwer Academic Publishers,2011.
5. Laung – Terng wang,Charles E.Stroud and Nur A.Touba., "System on Chip Test Architectures: Nano meter design Design for Testability", Morgan Kaufmann Publisher, 2007.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VII	OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECY21	RF MEMS	3	0	0	3	60	100	

Course Objective (s): The purpose of learning this course is to

- Study the Switch parameters Action Mechanisms of RF MEMS Switches.
- Understand the effect of inductor layout, approaches for Improving quality factor.
- Study Micro mechanical filters using comb drives, electrostatic coupled beam structures
- Study about the Micro machined transmission lines: Losses in Transmission Lines
- Understand the basic overview of micro strip antennas and design parameters.

Course Outcomes: At the end of this course, learners will be able to:

- Explain the Switch parameters Action Mechanisms of RF MEMS Switches.
- Design the effect of inductor layout, approaches for Improving quality factor.
- Explain Micro mechanical filters using comb drives, electrostatic coupled beam structures
- Gain the knowledge about the Micro machined transmission lines: Losses in Transmission Lines
- Explain the basic overview of micro strip antennas and design parameters.

Unit I	RFMEMS RELAYS AND SWITCHES	9

Introduction-Switch parameters Action Mechanisms of RF MEMS Switches - Electro Static, Magnetic & electromagnetic Bi-stable Relays and microactuators - Dynamics of Switching Operation MEMS Switch Modeling, design evaluation

Unit II	MEMS INDUCTORS AND CAPACITORS	9

Micro machining-Micro machining as a Fabrication process, Fabrication techniques-actuator mechanism pull- in voltage-Micro machined Passive elements pros and cons-MEMS Inductors-Micro machined inductor-Effect of inductor layout-Approaches for Improving quality factor-Modeling and design issues of planar inductor-Polymer based inductor-MEMS capacitors gap tuning and area tuning capacitors

Unit III	MICRO-MACHINED RF FILTERS	9

Introduction-Modeling of Mechanical Filters-Micro-machined filters-Electrostatic comb drive-Micro mechanical filters using comb drives, electrostatic coupled beam structures -SAW filters Basic/s-Design of Inter Digital Transducers-Capabilities, Limitations and applications-Micro machined filters for mmwave frequencies

Unit IV	MEMS PHASE SHIFTERS	9

Introduction-Types of Phase shifters-Limitations-MEMS phase shifters-Switched delay line, Distributed and polymer based-Ferro electric Phase shifters Distributed and bilateral Inter digitated-Micro machined transmission lines: Losses in Transmission Lines-Coplanar lines-Micro shield and membrance supported transmission lines- Micro machined directional; coupler & Mixer. Design, Fabrication and evaluation

Unit V	MICROMACHINED ANTENNAS	9

Introduction-Overview of Micro strip antenna-Design parameters-Micro machining to improve antenna performance-Reconfigurable antennas.

TEXT BOOK(S):

1. V.K.Varadan, K.J.Vinoyand K.A. Jose, RFMEMS and their applications, John Wiley & Sons Inc,2006
2. G.M.Rebeiz, RFMEMS: THEORY, Design and Technology: John Wiley & Sons Inc., 2010.

REFERENCE(S):

1. Hector J. DeSantos, RFMEMS circuit Design for Wireless Communications: Artech House,2002
2. www.marubeni-sys.com/mems/coventor/RF_MEMS_Application.pdf

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Department	ELECTRONICS AND COMMUNICAYION ENGINEERING				R 2019	Semester-VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ECX22	NANO ELECTRONICS	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Understand the underlying operating principles of nano devices,
- Know the Micro and mesoporous materials
- Study about the Sensors and high density data storage.
- Understand the concepts of Diffusive transport in quantum confined systems
- Know the Spin extraction and ferromagnetic proximity polarization

Course Outcomes: At the end of this course, learners will be able to:

- Comprehend the concepts of underlying operating principles of nano devices
- Analyze the special Micro and mesoporous materials
- Design and construct the Sensors and high density data storage.
- Perceive the Diffusive transport in quantum confined systems
- Utilize the concepts of Spin extraction and ferromagnetic proximity polarization

Unit I	INTRODUCTION TO NANOTECHNOLOGY	9

Introduction – Bottom-up and top-down approach- Zero-dimensional nanostructures – Nano particles through homogeneous nucleation and heterogeneous nucleation – One-dimensional nanostructures – Two-dimensional nanostructures – PVD – CVD – ALD

Unit II	SPECIAL NANO MATERIALS AND FABRICATION OF NANOSTRUCTURES	9

Carbon fullerenes and nano tubes – Micro and mesoporous materials- Core shell structures – Organic Inorganic hybrids – Lithographic techniques – Structural characterization and chemical characterization

Unit III	HYBRID SEMICONDUCTOR MOLECULAR INTEGRATED ELECTRONICS	9

Introduction – Devices – Circuits – CMOL memories – CMOL FPGA circuits – CMOL DSP circuits. Naono mechanics: Surface effect – Defects – Phase transitions – Sensors – High density data storage – Optics and telecommunications – Nano manipulators – Catalysis

Unit IV	TRANSPORT IN NANOSTRUCTURES	9

Introduction – Semiconductor device scaling – Quantum effect devices – Electronic transport in semiconductors – Transport in nano scale systems – Diffusive transport in quantum confined systems – Transmission and transport in nano scale systems – Single electron tunneling

Unit V	SPINTRONICS	9

Introduction – Metallic magnetic multilayers – Interlayer exchange coupling – Giant Magneto Resistance - Magnetic tunnel junctions- Spin torque – Magnetic Hard Drives – Magnetic Random Access Memory – Semiconductor spintronics: Ferromagnetic semiconductors – Spin coherence – Spin orbit coupling – Spin injection – Spin extraction and ferromagnetic proximity polarization – Lateral spin valve – Hanle effect – Spin hall effect

TEXT BOOK(S):

1. Pradeep.T, Nano The Essentials : Understanding nanoscience and nanotechnology, McGraw Hill Publishing Company Limited Principles of Communication Systems - Simon Haykin, 2nd Edition, John Wiley,2009

REFERENCE(S):

1. Simon Deleonibus, Electronic Device Architectures for the Nano-CMOS Era: From ultimate CMOS scaling to Beyond CMOS devices, Pan Stanford Publishing, Singapore, 2019

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Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX23	MODERN ELECTRONIC INSTRUMENTATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the different measuring instruments and sensors
- Study the Comparison of various transducer
- Understand programs for virtual systems using LabVIEW
- Study about virtual system using the features of LabVIEW
- Understand the ladder diagram for industrial applications.

Course Outcomes: At the end of this course, learners will be able to:

- Use different measuring instruments and sensors
- Compare the features of various transducer
- Develop programs for virtual systems using LabVIEW
- Create virtual system using the features of LabVIEW
- Draw ladder diagram for industrial applications.

Unit I	MEASUREMENT CONCEPTS AND MEASURING INSTRUMENTS	9

Measurement systems- Static and dynamic characteristics – Units and standards of measurements – Error analysis – Moving coil – Torque equations - Moving iron instruments – DC ammeters - DC voltmeters - Digital meters: Wattmeters - Energy meters – Bridge measurements: Maxwell- Kelvin-Schering- Anderson and Wien bridge.

Unit II	TRANSDUCERS	9

Strain gauge- Thermistor - Humidity sensor- Variable reluctance transducers – Linear variable differential transformer- Capacitive transducer – Piezoelectric transducers – Vibration sensor – Proximity sensor- Optoelectronic transducers-Instrumentation amplifier using operational amplifier.

Unit III	VIRTUAL INSTRUMENTATION & SOFTWARE	9

Block diagram of a virtual instrument – Physical quantities and analog interfaces - Hardware and software – User interfaces – Advantages– Architecture of a virtual instrument and its relation to operating system. LabVIEW – Graphical user interfaces - Controls and indicators.

Unit IV	VI SOFTWARE TOOLS & PROGRAMMING TECHNIQUES	9

Editing, debugging and running a virtual instrument – Graphical programming palettes and tools – Front panel objects – Function and libraries – VI and sub-VI–Programming of temperature conversion

Unit V	PLC PROGRAMMING	9

PLC Evolution – Components of PLC – Advantages over relay logic – PLC programming languages – Ladder diagram – Programming timers and counters

TEXT BOOK(S):

1. Helfrick Albert D, and Cooper William D., Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, New Delhi, 2015,
2. Jeffery Travis , Jim Kring, LabVIEW for Everyone: Graphical programming made easy and Fun, 3rd Edition, Pearson Education, India, 2015,

REFERENCE(S):

1. Ranganathan, S., Transducer Engineering, Allied Publishers, New Delhi, 2003.
2. LabVIEW Basics I and II Manual, National Instruments, 2005

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX24	COMPUTER ARCHITECTURE AND INTERFACING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Study the Bus structures, Software performance
- Know the Signed operand multiplication and fast multiplication
- Understand the simple implementation scheme
- Study the Mapping functions and Performance consideration
- Know the Direct Memory Access (DMA), Buses and Interface circuits

Course Outcomes: At the end of this course, learners will be able to:

- Comprehend the Bus structures, Software performance
- Utilize Signed operand multiplication and fast multiplication
- Explain the simple implementation scheme
- Explain the Mapping functions and Performance consideration
- Gain the knowledge about the Direct Memory Access (DMA), Buses and Interface circuits

Unit I	BASIC STRUCTURE OF COMPUTERS	9

Functional units- Basic operational concepts, Bus structures, Software performance – Memory locations & addresses – Memory operations – Instruction and instruction sequencing – Addressing modes – Assembly language – Basic i/o operations – Stacks and queues.

Unit II	ARITHMETIC	9

Addition and subtraction of signed numbers – Design of fast adders – Multiplication of positive numbers- Signed operand multiplication and fast multiplication – Integer division – Floating point numbers and operations.

Unit III	BASIC PROCESSING UNIT	9

Fundamental concepts – Building a data path – A simple implementation scheme - Execution of a complete Instruction – Multiple bus organization – Hardwired control – Microprogrammed control. Overview of Pipelining–Pipelined data path and Control – Hazards.

Unit IV	MEMORY SYSTEM	9

Basic concepts – Memory Hierarchy – Semiconductor RAMs, ROMs – Speed, size and cost – Cache memories – Mapping functions- Performance consideration – Virtual memory – Address translation

Unit V	I/O ORGANIZATION	9

Accessing I/O devices – Interrupts – Direct Memory Access (DMA) – Buses – Interface circuits – Standard I/O Interfaces (PCI, SCSI, USB).

TEXT BOOK(S):

1. Hamacher Carl, Vranesic Zvonko and Zaky Safwat, Computer Organization, 5th Edition, McGraw Hill, New York, 2011.

REFERENCE(S):

1. Stallings William, Computer Organization and Architecture: Designing for Performance, 11th Edition, Pearson Education, New Delhi, 2019.
2. Hayes John P, Computer Architecture and Organization, 3rd Edition, McGraw-Hill, New York, 1997.
3. Miles Murdocca and Vincent Heuring, Computer Architecture and Organization: An Integrated Approach, John Wiley and Sons Inc., 2008.

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Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX25	EMBEDDED INTERNET OF THINGS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the significance and applications of IoT
- Study the concepts of IoT based systems for Inter-disciplines
- Know about IoT based solutions using Rasperry Pi development board
- Study about the different control system with Arduino board
- Understand the programs using open source tools.

Course Outcomes: At the end of this course, learners will be able to:

- Comprehend the significance and applications of IoT
- Design IoT based systems for Inter-disciplines
- Provide IoT based solutions using Rasperry Pi development board
- Develop different control system with Arduino board
- Write programs using open source tools

Unit I	INTRODUCTION TO IoT	9

Definition and characteristics – Physical design – Logical design – Enabling technologies – Levels and deployment templates – Examples: Domain specific IoTs

Unit II	IoT NETWORKING	9

IoT and M2M – Software defined networking – Network function virtualization – System management with NETCONF-YANG – IoT design methodology

Unit III	IoT LOGICAL DESIGN	9

Data types – Data structures – Control flow – Functions – Modules – Packages – File Handling – Date and time operation – Classes – Python packages of IoT. IoT Physical Design: Basic building blocks – Raspberry Pi – Linux on Raspberry Pi – Interfaces – Programming on Raspberry Pi with Python

Unit IV	RASPBERRY Pi FOR PROJECT DEVELOPMENT	9

Raspberry Pi platform – GPIO – Establishment and setting of Raspberry Pi software – LAMP project – Home temperature monitoring system – Webcam and Raspberry Pi camera project

Unit V	CASE STUDY - ARDUINO FOR PROJECT DEVELOPMENT	9

Internet enabled Arduino powered garage door opener – Irrigation control system – Light controller. Beagle bone black for Project development: Message controller and cloud Services-WiFi Module

TEXT BOOK(S):

1. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-On Approachll, Arshdeep Bahga, Vijay Madisetti , 2014
2. Donald Norris , The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black, 1st Edition, McGraw Hill, 2015

REFERENCE(S):

1. Donald Norris, Raspberry Pi Projects for the Evil Genius, McGraw Hill Professional,2014
2. Adrian McEwen (Author), Hakim Cassimally, Designing the Internet of Things,1st Edition, John Wiley and sons, 2014
3. Cuno Pfister.Getting started with the Internet of Things, 1st Edition, O'Reilly Media Inc, 2011

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX26	SATELLITE COMMUNICATION	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Study about the spacecraft sub system used in satellite communication
- Know the various subsystems of spacecraft
- Understand the characteristics satellite links
- Know the various medium access techniques
- Understand the different types of broadcasting/military applications and multimedia services

Course Outcomes: At the end of this course, learners will be able to:

- Identify the spacecraft sub system used in satellite communication
- Analyze various subsystems of spacecraft
- Design and analyze the characteristics satellite links
- Analyze the various medium access techniques
- Apply different types of broadcasting/military applications and multimedia services

Unit I	SATELLITE ORBITS	9

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

Unit II	SPACE SEGMENT	9

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders-The Antenna Subsystem.

Unit III	SATELLITE LINK DESIGN	9

Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.

Unit IV	SATELLITE ACCESS AND CODING METHODS	9

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, DAMA Assignment Methods, compression – encryption, Coding Schemes.

Unit V	SATELLITE APPLICATIONS	9

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH) – Case Study

TEXT BOOK(S):

1. Dennis Roddy, Satellite Communication, 4th Edition, Mc Graw Hill International, 2nd Edition,2011.
2. Timothy,Pratt,Charles,W.Bostain,JeremyE.Allnutt,"SatelliteCommunication,2ndEdition,Wiley Publications,3rd Edition,2020

REFERENCE(S):

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, Satellite Communication Systems Engineering, Prentice Hall/Pearson, 2007
2. N.Agarwal, Design of Geosynchronous Space Craft, Prentice Hall, 1986.
3. Bruce R. Elbert, The Satellite Communication Applications, Hand Book, Artech House Bostan London, 2006.
4. Tri T. Ha, Digital Satellite Communication,2nd edition, 1990.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ECX27	GLOBAL POSITIONING SYSTEMS	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Learn the fundamentals of GPS
- Learn the characteristics of signals
- Impart knowledge on GPS receivers & data errors
- Learn the various types of GPS
- Learn the applications of GPS

Course Outcomes: At the end of this course, learners will be able to:

- Indentify the fundamentals of GPS
- Analyze the characteristics of signals
- Impart knowledge on GPS receivers & data errors
- Comprehend the various types of GPS
- Learning the applications of GPS

Unit I	INTRODUCTION	9

GPS and GLONASS Overview – Satellite Navigation -Time and GPS – User position and velocity calculations – GPS – Satellite Constellation – Operation Segment – User receiving Equipment – Space Segment Phased development.

Unit II	SIGNAL CHARACTERISTICS	9

GPS signal components – purpose, properties and power level – signal acquisition and tracking – Navigation information extraction – pseudo range estimation – frequency estimation – GPS satellite position calculation.

Unit III	GPS RECEIVERS & DATA ERRORS	9

Receiver Architecture – receiver design options – Antenna design – SA errors – propagation errors – Methods of multipath mitigation – Ephemeris data errors – clock errors.

Unit IV	DIFFERENTIAL GPS	9

Introduction – LADGPS – WADGPS, Wide Area Augmentation systems – GEO Uplink subsystem – GEO downlink systems – Geo Orbit determination – Geometric analysis – covariance analysis – GPS /INS Integration Architectures

Unit V	GPS APPLICATIONS	9

GPS in surveying, Mapping and Geographical Information System – Precision approach Aircraft landing system – Military and Space application – Intelligent transportation system.

REFERENCE(S):

1. Mohinder S.Grewal, Lawrence R.Weill, Angus P.Andrews, "Global positioning systems Inertial Navigation and Integration", John Wiley & sons, 2007.
2. E.D.Kaplan, Christopher J. Hegarty, "Understanding GPS Principles and Applications", Artech House Boston,3rd Edition, 2017.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX28	RADAR AND NAVIGATIONAL AIDS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Study the principles of radar
- Understand the operation of Moving Target Indicator and pulse Doppler radar
- Gain concepts of navigational system
- Compare different navigation systems
- Study the instrument landing system and distance measuring equipment

Course Outcomes: At the end of this course, learners will be able to:

- Discuss principles of radar
- Describe operation of Moving Target Indicator and pulse Doppler radar
- Explain concepts of navigational system
- Explain the different navigation systems
- Discuss instrument landing system and distance measuring equipment

Unit I	INTRODUCTION TO RADAR	9

Radar Block Diagram- Radar Frequencies – Radar equation –Applications of Radar – Probabilities of Detection and False Alarm- Integration of Radar Pulses- Radar Cross Section of Targets- Radar cross Section Fluctuations- Transmitter Power- Pulse Repetition Frequency- Antenna Parameters - System losses.

Unit II	MTI AND PULSE DOPPLER RADAR	9

Introduction to Doppler and Moving Target Indicator (MTI) Radar- Delay Line Cancellers - Staggered Pulse Repetition Frequencies – Digital MTI Processing - Moving Target Detector - Limitations to MTI Performance - MTI from a Moving Platform . Pulse Doppler Radar – Tracking with Radar – Monopulse Tracking –Conical Scan and Sequential Lobing - Limitations to Tracking Accuracy – Low Angle Tracking - Tracking in Range - Other Tracking Radar Topics -Comparison of Trackers - Tracking with Surveillance Radars (ADT).

Unit III	DETECTION OF SIGNAL	9

Introduction – Automatic Detector - Constant False Alarm Rate Receivers - Radar operator - Propagation Radar Waves - Atmospheric Refraction -Standard propagation - Nonstandard Propagation - Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas - Phase Shifters – Frequency Scan Arrays. Radar Transmitters - Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron Radar Receivers - Receiver noise Figure - Superheterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.

Unit IV	METHODS OF NAVIGATION	9

Radio Direction Finding - Loop Antenna - Loop Input Circuits - Aural Null Direction Finder - Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders - Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders Radio Ranges - LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR - Hyperbolic Systems of Navigation (Loran and Decca) – Loran A Equipment - Range and precision of Standard Loran – Loran C - Decca Navigation System - Decca Receivers - Range and Accuracy of Decca - Omega System.

Unit V	DME AND TACAN	9

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Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment Approach and Landing - Instrument Landing System (ILS) - Ground Controlled Approach (GCA) System - Microwave Landing System (MLS) Doppler Navigation - Doppler Effect - Beam Configurations - Doppler Frequency Equations - Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation - Accuracy of Doppler Navigation Systems.

TEXT BOOK(S):	
1.	Merrill I. Skolnik ," Introduction to Radar Systems", Tata McGraw-Hill (3rd Edition) 2018.
2.	N.S.Nagaraja, Elements of Electronic Navigation Systems, 2nd Edition, Tata McGraw-Hill, 2000.

REFERENCE(S):	
1.	Myron Kyton and W.R.Fried Avionics Naviagtion systems , John wiley & sons, (2nd Edition) 1997.
2.	Albert Helfrick.D,, Principles of Avionics, Avionics communications Inc,2015.
3.	Peyton Z. Peebles: "Radar Principles", John wiley, 2004.
4	J.C Toomay, " Principles of Radar", 2nd Edition Prentice Hall India, 2008.

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Department	ELECTRONICS AND COMMUNICAYION ENGINEERING					R 2019	Semester-VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX29	REMOTE SENSING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Develop technical skills and competence in data and information acquisition, extraction, management and analysis; spatial and statistical modelling; mapping and visualization.
- Increase awareness of GIS and modelling tools for improving competition and business potential.
- Describe how geographical information is used, managed, and marketed globally.
- Gain an understanding of how to manipulate and apply vector and raster spatial data, particularly with regard to local/state/national issues, emphasizing lands in and near it.
- Understand the principles, applications, trends, and pertinent issues of geographical information systems and sciences, including remote sensing (RS), Photogrammetry, cartography, and global positioning systems (GPS).

Course Outcomes: At the end of this course, learners will be able to:

- Explain the concepts of remote sensing in the electromagnetic spectrum physics
- analyze the performance of LANDSAT,SPOT and its image interpretation
- appreciate and comprehend the microwave and LIDAR remote sensing
- acquire knowledge on data analysis in remote sensing
- evaluate the performance of space and aerial platforms

Unit I	Physics of Remote Sensing	9

Introduction of Remote Sensing, Electro Magnetic Spectrum Physics of Remote Sensing – Energy sources and radiation principles-Energy interactions in Atmosphere - Scattering - Absorption - Energy interactions with earth surface features- Spectral reflectance of vegetation soil and water.

Unit II	Data Acquisition (Space and Aerial Platforms)	9

Types of Platforms - Different types of aircrafts - Manned - Unmanned spacecrafts - Sun synchronize - Geo synchronize satellites - Photographic products, B/W - Colour-Colour IR film and their characteristics -Multi spectral scanners and thermal scanners - Geometric characteristics of scanner imagery calibration thermal scanners.

Unit III	Earth Resource Satellites in Optical Spectrum	9

Overview of LANDSAT-LANDSAT -1,2 and 3, LANDSAT image interpretation- SPOT satellite program; SPOT-1,2 and 3,SPOT image interpretation.

Unit IV	Microwave and LIDAR remote sensing	9

Concept of microwave remote sensing - Types of RADARS - SLAR - Resolution - Range and azimuth -Real aperture and synthetic aperture RADARS -ERS - JERS - RADARSAT - LIDAR aerial laser terrain mapping.

Unit V	Data Analysis in remote sensing	9

Scatterometer, altimeter. Resolution - Spatial - Spectral - Radiometric and temporal resolution - Signal to noise ratio – Different types of data products and their characteristics visual and digital interpretation –Image rectification and restoration- Geometric correction - Radiometric correction - Image enhancement - Different types – Image classification –Supervised classifications

TEXT BOOK(S):

1. Lillesand T.M. and Kieer R.W., Remote sensing and Image Interpretation, 4th Edition, 2015.
2. Paul Curran, P. J. Principles of Remote Sensing, ELBS, 1995.of John Wiley and Sons, 2000.

REFERENCE(S):

1. Sabins Jr, F.F., Remote Sensing Principles and Image interpretation, Waveland Pr Inc., 2007
2. Rees G.Physical principles of remote sensing,3rd edition, Cambridge University Press 2012

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VIII	PE
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX30	WIRELESS SYSTEM AND STANDARDS	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Study the basic knowledge on cellular standards
- Discuss various wireless systems
- Understand the WLAN standard
- Study about the IMAX standard
- Impart the knowledge on recent techniques

Course Outcomes: At the end of this course, learners will be able to:

- Explain the basic knowledge on cellular standards
- Identify the various wireless systems
- Explain WLAN standard
- Explain IMAX standard
- Impart the knowledge on recent

Unit I	INTRODUCTION TO CELLULAR STANDARDS	9

2G GSM, Cell structure, Frequency Bands and Channels- Call processing, Identity numbers, Frame structure, Interfaces, GMSK modulation, Voice and data processing, GPRS, EDGE, EDGE+, CDMA signal processing, IS-2000 system, Frequency bands, Channel allocation, CDMA cell capacity, services provided by IS-2000, 1xEVDO signal processing and data services-3G UMTS signal processing, WCDMA, HSPA, HSPA+, Towards 4G, LTE and LTE advanced.

Unit II	WIRELESS SYSTEMS	9

Advanced Mobile Phone Systems (AMPS) – Characteristics – Operation – General Working of AMPS Phone System – Global System for Mobile Communication – Frequency Bands and Channels – Frames – Identity Numbers – Layers, Planes and Interfaces of GSM – International Mobile Telecommunications (IMT-2000) – Spectrum Allocation – Services provided by 3G Cellular Systems – Harmonized 3G Systems – Universal Mobile Telecommunications Systems (UMTS).

Unit III	THE IEEE 802.11 WLAN STANDARD:	9

Introduction to IEEE 802.11 – General Description – Medium Access Control (MAC) – Physical Layer for IEEE 802.11 Wireless LANs; Radio systems – IR Systems Applications.

Unit IV	THE IEEE 802.16 WIMAX STANDARD	9

Introduction to IEEE 802.16 – General Description – Medium Access Control (MAC) –Radio systems – Physical Layer- Evolution to 802.16m-Bluetooth, Zigbee

Unit V	RECENT ADVANCES	9

Introduction – Ultra Wide Band (UWB) Technology – Characteristics – Signal Propagation – Current Status and Applications – Advantages – Disadvantages – Challenges and Future Directions.

TEXT BOOK(S):

1. Assuncion Santamaria, Francisco Lopez-Hernandez, Wireless LAN Standards and Applications, Artech House, 2006.
2. Dharma Prakash Agarwal and Qing- An zeng, Introduction to Wireless and Mobile Systems, Vikas publishing House, New Delhi, 2016.

REFERENCE(S):

1. Neeli Prasad and Anand Prasad, WLAN System & Wireless IP for Next Generation Communications, Artec House, 2002.
2. Moray Rumney : LTE and the Evolution to 4G Wireless,Wiley,2013

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX31	NETWORK ON CHIP	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Introduce the concept of 3D NOC.
  Ffamiliarize interconnection Networks in NoC
- Aacquaint the architectures design ofNoC
- Learn about the testing of NOC
- Understand low power Techniques in NOC

Course Outcomes: At the end of this course, learners will be able to:

- Develop NoC
- Select a suitable switching and routing techniques
- Analyze different types of architectures
- Test NOC
- Apply Low power techniques in NoC

Unit I	INTRODUCTION TO NOC	9

Introduction System-on-Chip Integration and Its Challenges-SoC to Network-on-Chip: A Paradigm Shift- Research Issues in NoC Development Existing NoC Examples

Unit II	INTERCONNECTION NETWORKS IN NETWORK-ON-CHIP	9

Introduction-Network Topologies-Switching Techniques-Routing Strategies-Flow Control Protocol - Quality-of-Service Support-NI Module

Unit III	ARCHITECTURE DESIGN OF NETWORK-ON-CHIP	9

Introduction-Switching Techniques and Packet Format-Asynchronous FIFO Design-GALS Style of Communication-Wormhole Router Architecture Design-VC Router Architecture Design-Adaptive Router Architecture Design

Unit IV	TESTING OF NETWORK-ON-CHIP ARCHITECTURE	9

NoC testing introduction-Testing communication Fabric-Test Transport time minimization-Testing cores- Heuristic algorithm-PSO baced strategy

Unit V	LOW-POWER TECHNIQUES FOR NETWORK-ON-CHIP	9

Introduction-Standard Low-Power Methods for NoC Routers-Standard Low-Power Methods for NoC Links-Local reconfiguration technique.Introduction-3-D Integration: Pros and Cons-Design and Evaluation of 3-D NoC Architecture-System- Level Power Reduction-Applications of 3D NoC

REFERENCE(S):

1.	Santanu Kundu, Santanu Chattopadhyay, Network-on-Chip: The Next Generation of System-on-Chip Integration, Taylor & Francis group2015.
2.	Chrysostomos Nicopoulos, Vijaykrishnan Narayanan, Chita R.Das, Networks-on- Chip Architectures AHolistic Design Exploration, Springer,2010.
3.	Fayezgebali, Haythamelmiligi, Hqhahed Watheq E1-Kharashi, Networks-on-Chips theory and practice, CRC press, 2017.
4	Axel Jantsch , Hannu Tenhunen, Networks on Chip, Publisher: Springer; Soft cover reprint of hardcover,2004
5	Giovanni De Micheli , Luca Benini, Networks on Chips: Technology and Tools (Systems on Silicon), Publisher: Morgan Kaufmann,2006.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ECX32	COMPUTATIONAL ELECTROMAGNETICS	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Learn different laws of electromagnetics
- Understand numerical differentiation.
- Know the concepts of method of moments
- Understand time domain methods
- Know the different applications of CEM

Course Outcomes: At the end of this course, learners will be able to:

- Apply various laws of Electromagnetics
- Comprehend the functionalities of numerical differentiation.
- Apply the concepts of method of moments
- Design and implement finite difference time domain methods
- Investigate different applications of CEM

UNIT I	EM REVIEW	9

E-field, permittivity, Coulombs Law, Flux of a vector field, Gausss Law for E fields (Integral), divergence, Gauss Law for E fields (Differential) B-field, permeability, Biot-Savart law, Gausss law for B fields (integral and differential), Divergence Theorem, circulation of a vector field, curl, Stokes Theorem. Gradient. Laplacian. Poisson and Laplace equations. Ampere-Maxwell Law, Faraday-Maxwell Law. Continuity equation. Constitutive equations.

UNIT II	NUMERICAL DIFFERENTIATION	9

Forward difference, backward difference, central difference. Higher order derivatives. Partial derivatives. Solution of Linear Systems: Matrix equivalent. Solution sets. Direct vs iterative methods. Sparse matrices. Libraries. Gaussian Elimination. Gauss-Seidel method. Numerical Integration Riemann Sums Left/right-point rules Midpoint, trapezoid, Simpsons rules Error bounds-Numerical Integration Examples

UNIT III	METHOD OF MOMENTS	9

Greens Functions; Surface equivalence principle; Electrostatic formulation; Magnetostatic formulation; Electric Field Integral Equation; Magnetic Field Integral Equation; Direct and Iterative Solvers

UNIT IV	FINITE DIFFERENCE TIME DOMAIN METHODS	9

1D wave propagation, yee Algorithm, Numerical dispersion and stability, perfectly matched absorbing boundary conditions, Dispersive materials. Antenna and scattering problems with FDTD, non-uniform grids, conformal grids, periodic structures.

UNIT V	APPLICATIONS OF CEM	9

Antennas, biological electromagnetic effects, electronic packing and high speed circuits, microwave devices and circuits, environmental issues. surveillance and intelligence gathering, homeland security, signal integrity.

REFERENCE(S):

1.	Walton C Gibson,The Method of Moments in Electromagnetics , CRC Press,2015.
2.	Andrew F Peterson, Scott L Ray and Raj Mittra, Computational Methods for Electromagnetics, IEEE Press Series on Electromagnetic Wave Theory,2001.
3.	Roger F Harrington,Field Computation by Moment Methods, IEEE Press, 1993.
4	Taflove A and Hagness SC, —Computational Electrodynamics: The Finite Difference Time Domain Method, Artech House,2004.

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Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX33	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Introduce the basic concepts in cryptography and network security
- Study the concepts in symmetric cryptography
- Learn about various public key cryptography
- Learn about confidentiality, integrity of a data.
- Understand the various system security issues

Course Outcomes: At the end of this course, learners will be able to:

- Apply the concepts of cryptography and network security
- Apply the concepts in symmetric cryptography
- Demonstrate and apply public key cryptography
- Practice message authentication and integrity of data.
- Solve system security issues

Unit I	INTRODUCTION	9

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography).- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

Unit II	SYMMETRIC CRYPTOGRAPHY	9

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid's algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.

Unit III	PUBLIC KEY CRYPTOGRAPHY	9

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

Unit IV	MESSAGE AUTHENTICATION AND INTEGRITY	9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

Unit V	SECURITY PRACTICE AND SYSTEM SECURITY	9

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

TEXT BOOK(S):

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2017.

REFERENCE(S):

1. C K Shyamala, N Harini and Dr. T R Padmanabhan:Cryptography and Network Security, Wiley India Pvt.Ltd
2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall.

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Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX34	COGNITIVE RADIO	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Study the principles of the software defined radio
- Describe the architecture of software defined radio
- Study the design considerations of cognitive radio
- Illustrate cognitive radio architecture
- Apply the knowledge of spectrum sensing, cross-layer design for cognitive radio

Course Outcomes: At the end of this course, learners will be able to:

- Apply the principles of the software defined radio
- Design a system with the knowledge of the architecture of software defined radio
- Apply Cognitive Techniques and Artificial Intelligence Techniques.
- Build cognitive radio architecture on SDR
- Manage spectrum sharing and upper layer issues

Unit I	INTRODUCTION TO SOFTWARE DEFINED RADIO	9

Definitions and potential benefits, software radio architecture evolution, technology tradeoffs and architecture implications.

Unit II	SDR ARCHITECTURE	9

Essential functions of the software radio, basic SDR, hardware architecture, Computational processing resources, software architecture, top level component interfaces, interface topologies among plug and play modules.

Unit III	INTRODUCTION TO COGNITIVE RADIOS	9

Marking radio self-aware, cognitive techniques – position awareness, environment awareness in cognitive radios, optimization of radio resources, Artificial Intelligence Techniques.

Unit IV	COGNITIVE RADIO ARCHITECTURE	9

Cognitive Radio - functions, components and design rules, Cognition cycle - orient, plan, decide and act phases, Inference Hierarchy, Architecture maps, Building the Cognitive Radio Architecture on Software defined Radio Architecture.

Unit V	NEXT GENERATION WIRELESS NETWORKS	9

The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

TEXT BOOK(S):

1. Joseph Mitola III,"Software Radio Architecture: Object-Oriented Approaches to Wireless System Engineering", John Wiley & Sons Ltd. 2004.
2. Thomas W.Rondeau, Charles W. Bostain, "Artificial Intelligence in Wireless communication", ARTECH HOUSE .2009.
3. Bruce A. Fette, "Cognitive Radio Technology", Elsevier, 2009.
4. Ian F. Akyildiz, Won – Yeol Lee, Mehmet C. Vuran, Shantidev Mohanty, "Next generation /dynamic spectrum access / cognitive radio wireless networks: A Survey" Elsevier Computer Networks, May 2006.

REFERENCE(S):

1. Simon Haykin, "Cognitive Radio: Brain Empowered Wireless Communications", IEEE Journal on selected areas in communications, Feb 2005.
2. Hasari Celebi, Huseyin Arslan, "Enabling Location and Environment Awareness in Cognitive Radios", Elsevier Computer Communications, Jan 2008.
3. Markus Dillinger, Kambiz Madani, Nancy Alonistioti, "Software Defined Radio", John Wiley, 2005.
4. Huseyin Arslan, "Cognitive Radio, SDR and Adaptive System", Springer, 2007.

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Department	ELECTRONICS AND COMMUNICAYION ENGINEERING					R 2019	Semester-VIII	PE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECX35	SOFT COMPUTING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand the concepts of Neural Network
- Edify learning Networks
- Know about Fuzzy Logic
- Introduce Genetic Algorithm
- Be aware of the applications of Neural networks,Fuzzy and Genetic Algorithm

Course Outcomes: At the end of this course, learners will be able to:

- Apply the concepts of Neural Network
- Design a system with Neural Networks
- Develop a rule based Fuzzy systems
- Apply Genetic algorithm in problem solving
- Apply Neural Network and Fuzzy Logic control to real time systems

Unit I	NEURAL NETWORKS	9

Introduction – Architecture – Back propagation for Feed forward Networks – Extended back propagation for recurrent networks – Hybrid Learning rule : Combining Steepest Descent and LSE.

Unit II	LEARNING NETWORKS	9

Supervised Learning Neural Networks : Perceptrons – Adaline – Back propagation Multilayer Perceptrons ,UnSupervised Learning : Competitive Learning Networks – Kohonen Self – Organising Networks – Learning Vector Quantization – Hebbian Learning.

Unit III	FUZZY LOGIC	9

Fuzzy Sets: Introduction – Basic Definitions and terminologies – MF Formulation and Parameterization – Fuzzy rules – Fuzzy Relations – Fuzzy reasoning – Mamdani Fuzzy models – Sugeno Fuzzy Models – Tsukamoto Fuzzy models.

Unit IV	GENETIC ALGORITHM	9

Genetic algorithm- Introduction – Biological background –General genetic algorithm – Encoding – Binary, Octal, Hex, Permutation - Value and tree - Reproduction- Cross over – Mutation – Fitness scaling – Codings – Multiparameter, mapped , Fixed point coding – Discretization – Constraints.

Unit V	APPLICATIONS	9

Fuzzy Filtered Neural Networks: Plasma Spectrum Analysis – Hand – Written Numeral Recognition - Genetic Algorithm - Medical Image Registration with Genetic Algorithms – Iterated Prisoner's Dilemma Problem - Introduction to Artificial Intelligence.

TEXT BOOK(S):

1. J.S.R.Jang, C.T.Sun, E.Mizutani, Neuro Fuzzy and Soft Computing Prentice Hall of India, 2015.
2. David E.Goldberg, Genetic Algorithms Pearson, 2008.

REFERENCE(S):

1. Timothy J.Ross, Fuzzy Logic with engineering Applications, Wiley India, Third Edition, 2017.
2. Laurene Fausett, Fundamentals of Neural Networks Architecture, Algorithms and Applications Pearson Education, 2008.

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OPEN ELECTIVE

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-V	OE
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECY01	VLSI DESIGN	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Study the fundamentals of CMOS circuits and its characteristics.
- Learn the design and realization of combinational digital circuits.
- Learn the design and realization of sequential digital circuits.
- Learn arithmetic building blocks
- Introduce Verilog HDL

Course Outcomes: At the end of this course, learners will be able to:

- Realize the digital building blocks using MOS transistor.
- Design combinational MOS circuits and power strategies.
- Design and construct Sequential Circuits and Timing systems.
- Design arithmetic building blocks and memory subsystems.
- Apply and implement FPGA design flow and testing.

Unit I	INTRODUCTION TO MOS TRANSISTOR	9

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

Unit II	COMBINATIONAL MOS LOGIC CIRCUITS	9

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls. **Power:** Dynamic Power, Static Power, Low Power Architecture.

Unit III	SEQUENTIAL CIRCUIT DESIGN	9

Static latches and Registers, Dynamic latches and Registers, Pipelining, Timing Issues, clock strategies

Unit IV	DESIGN OF ARITHMETIC BUILDING BLOCKS	9

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.

Unit V	Verilog HDL	9

Overview of Digital Design with Verilog HDL- Hierarchical Modeling Concepts- Gate Level Modeling- Dataflow Modeling- Behavioral Modeling- Design of Combinational Circuits: Ripple Carry adder-Array Multiplier - Multiplexer and Demultiplexer. Design of Sequential Circuits: Flip Flops-synchronous and asynchronous Counter.

TEXT BOOK(S):

1. Neil H.E. Weste, David Money Harris CMOS VLSI Design: A Circuits and Systems Perspective, 4th Edition, Pearson , 2017 (UNIT I,II)
2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, Digital Integrated Circuits:A Design perspective, Second Edition , Pearson , 2016.(UNIT III,IV)
3. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, New Delhi, 2003 (unit-V)

REFERENCE(S):

1. Sung-Mo kang, Yusuf leblebici, Chulwoo Kim CMOS Digital Integrated Circuits:Analysis & Design,4th edition McGraw Hill Education,2013.
2. R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice , Hall of India 2005

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-V	OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECY02	COMMUNICATION ENGINEERING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Understand analog communication techniques.
- Learn pulse Modulation techniques.
- Understand digital communication techniques
- Understand multiuser Radio communication
- Learn Communication Technologies.

Course Outcomes: At the end of this course, learners will be able to:

- Apply analog communication techniques.
- Apply pulse Modulation techniques
- Apply digital communication techniques
- Design multi-user radio communication system
- Analyze and apply Communication Technologies

Unit I	ANALOG COMMUNICATION	9

Introduction to Communication Systems - Modulation – Types - Need for Modulation. Theory of Amplitude Modulation – SSB & DSB Techniques - Theory of Frequency and Phase Modulation – Comparison of Analog Communication Systems (AM – FM – PM).

Unit II	MODULATION TECHNIQUES	9

Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of various Pulse Communication System (PAM – PTM – PCM) – Overview about Data Communication and its standards.

Unit III	DIGITAL COMMUNICATION	9

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

Unit IV	MULTI-USER RADIO COMMUNICATION	9

Global System for Mobile Communications (GSM) - Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Handover Techniques - Overview of Multiple Access Schemes.

Unit V	COMMUNICATION TECHNOLOGIES	9

Overview of Next Generation Communication (3G,4G) – Introduction to Optical Communication - Satellite Communication – Bluetooth – Comparison of Communication Technologies : Bluetooth, Zigbee, Wi-Fi, Wi-Max, Li-Fi – IoT.

TEXT BOOK (S):

1. Wayne Tomasi,Advanced Electronic Communication Systems,6th Edition,Pearson Education, 2013.
2. Simon Haykin, Communication Systems, 5th Edition, John Wiley & Sons, 2010
3. Rappaport T.S, "Wireless Communications: Principles and Practice",2nd Edition, Pearson Education, 2018

REFERENCE(S):

1. H.Taub, D L Schilling and G Saha,Principles of Communication,4th Edition,Pearson Education, 2013.
2. B. P.Lathi, Modern Analog and Digital Communication Systems, 5th Edition, Oxford University Press, 2019.
3. Blake, Electronic Communication Systems, Thomson Delmar Publications, 2002.
4. Martin S.Roden, Analog and Digital Communication System, 3rd Edition,Prentice Hall of India, 2002

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-V	OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECY03	PCB DESIGN	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Learn the fundamentals of PCB Designing
- Learn about the various components and their category
- Introduce the various development tools'
- Describe the PCB designing
- Introduce PCB design concepts

Course Outcomes: At the end of this course, learners will be able to:

- Follow the PCB Design concept
- Choose components dependent on the requirement
- Apply development tools
- Design PCB
- Apply PCB design concepts in real time.

Unit I	INTRODUCTION TO PCB DESIGNING CONCEPTS	9

Introduction and brief history - PCB - Difference between PWB and PCB - Types of PCBs - Single Sided (Single Layer) - Multi-Layer (Double Layer) - PCB Materials Trends in PCB Designing - Older PCB Method - PCB Designing Using Graph Paper - Making a hand drawn PCB - Using Computer for EDA Introduction to Electronic design automation (EDA) - History - Latest Trends in Market - Different EDA tools - Introduction to SPICE and PSPICE Environment - Introduction and Working of PROTEUS

Unit II	COMPONENT INTRODUCTION AND THEIR CATEGORIES	9

Types of components - Active Components - Diode - Transistor - MOSFET - LED - SCR - Integrated Circuits (Ics) - Passive Components - Resistor - Capacitor - Inductor - Transformer - Speaker/Buzzer, Component Package Types - Through Hole Packages - Axial lead - Radial Lead - Single Inline Package(SIP) - Dual Inline Package(DIP) - Transistor Outline(TO) - Pin Grid Array(PGA), Through Hole Packages - Metal Electrode Face(MELF) - Leadless Chip Carrier(LCC) - Small Outline Integrated Circuit(SOIC) - Quad Flat Pack(QPF) and Thin QFP (TQFP) - Ball Grid Array(BGA) - Plastic Leaded Chip Carrier(PLCC)

Unit III	INTRODUCTION TO DEVELOPMENT TOOLS	9

Introduction of PROTEUS ISIS software For Schematic Entry - Brief Introduction of various simulators - Description to Proteus ISIS simulator tool - Hands on practice on available library of components - working through wiring and schematic designing - Making New Component Symbols, Introduction of PROTEUS ARES software for PCB Designing - Connecting the schematic From ISIS to ARES for Netlising - Selecting the Components Footprints as per design - Picking and placing the Component - Making New Footprints - Assigning Footprint to components

Unit IV	DESCRIPTION OF PCB DESIGNING	9

PCB Designing Flow Chart - Schematic Entry - Netlisting - PCB Layout Designing - Prototype Designing - Design Rule Check(DRC) - Design For Manufacturing(DFM) - PCB Making - Printing - Etching - Drilling - Assembly of components, Description of PCB Layers - Electrical Layers - Top Layer - Mid Layer- Bottom Layer - Mechanical Layers - Board Outlines and Cutouts - Drill Details - Documentation Layers - Components Outlines - Reference Designation - Text, Keywords and Their Description - Footprint - Pad stacks - Vias - Tracks - Color of Layers - PCB Track Size Calculation Formula, PCB Materials - Standard FR-4 Epoxy Glass - Multifunctional FR-4 - Tetra Functional FR-4 - NelcoN400-6 - GETEK - BT Epoxy Glass - Cyanate Aster - Plyimide Glass - Teflon, Rules For

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Track - Track Length - Track Angle - Rack Joints - Track Size, Study of IPC Standards - IPC Standard For Schematic Design - IPC Standard For PCB Designing - IPC Standard For PCB Materials - IPC Standard For Documentation and PCB Fabrication		
Unit V	**DESIGNING CONCEPTS**	**9**
Starting The PCB Designing :Understanding the schematic Entry - Creating Library & Components - Drawing a Schematic - Flat Design / hierarchical Design - Setting up Environment for PCB - Design a Board, Autorouting : Introduction to Autorouting - Setting up Rules - Defining Contraints - Autorouter Setup, PCB Designing Practice : PCB Designing of Basic and Analog Electronic Circuits - PCB Designing of Power Supplies - PCB Designing of Different Sensor modules - PCB Designing of Electronics Projects - PCB Designing of Embedded Projects, Post Designing and PCB Fabrication Process : Printing the Design - Eaching - Drilling - Interconnecting and Packaging electronic Circuits (IPC) Standards - Gerber Generation - Soldering and Desoldering - Component Mounting - PCB and Hardware Testing		

REFERENCE(S):

1.	Altium Designer Tutorial By Glenn Mercier First Edition, 2009
2.	Printed Circuits Handbook, Seventh Edition by Clyde Coombs Happy Holden Tata Mcgraw hill Publication
3.	Altium Rigid Flex-PCB Design A Guide Books for Designers by Ben Jordan
4.	The Circuit Designer's Companion by Peter Wilson Professor Newnes Publication
5.	Circuit design standard course for Altium Designer by yong yang chen xiao ge by Science Press

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-V	OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ECY04	AUTOMOTIVE ELECTRONICS	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Understand the concepts of Automotive Electronics
- Know about ignition and injection systems
- Learn sensors and actuators for automotive applications
- Understand Engine and Emission control Systems
- Introduce Chassis and Safety Systems

Course Outcomes: At the end of this course, learners will be able to:

- Apply the concepts of Automotive Electronics
- Analyze ignition and injection systems
- Apply sensors and actuators for automotive applications
- Design Engine and Emission control Systems
- Implement Safety systems with Chassis

Unit I	INTRODUCTION	9

Evolution of electronics in automobiles – Emission test – Introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards. Charging systems: Working, charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

Unit II	IGNITION AND INJECTION SYSTEMS	9

Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control - Basics of combustion – Engine fuelling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – Diesel fuel injection.

Unit III	SENSORS AND ACTUATORS	9

Working principle and characteristics of sensors: Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, Temperature, Exhaust gas oxygen sensor. Study of fuel injector, Exhaust gas recirculation actuators, Stepper motor actuator and Vacuum operated actuator.

Unit IV	ENGINE AND EMISSION CONTROL SYSTEMS	9

In vehicle networks: CAN, LIN, FLEXRAY, MOST, KWP2000. Control modes for fuel control-engine control subsystems – Ignition control methodologies – Engine management system. Catalytic converter – EGR – SCR – DeNox Trap. Diagnostics systems in modern automobiles.

Unit V	CHASSIS AND SAFETY SYSTEMS1000	9

Electronic transmission control. Traction control system – Adaptive cruise control – Electronic control of automatic transmission - Antilock braking system - Electronic Stability Program – Electronic suspension system – Working of airbag and role of MEMS in airbag systems –Seat belt tensioners. Centralized door locking system – Climate control of cars.

TEXT BOOK(S):

1. Tom Denton, Automobile Electrical and Electronics Systems, 5th Edition, Edward Arnold Publishers, London, 2018.
2. Ribbens, William B. Understanding Automotive Electronics, 7th Edition, Butterworth-Heinemann, Burlington, 2013.

REFERENCE(S):

1. C.A. Schuler and W.L. .Mc Namee, Modern Industrial Electronics, McGraw Hill, 2002.
2. Hollembeak, Barry., Automotive Electricity, Electronics & Computer Controls, Delmar Publishers, New York, 2002.

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Dept. of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-VI	OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ECY05	ELECTRONIC MATERIALS	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Understand the concept of atomic structures and bonding
- Study conducting materials
- Learn semiconductor and magnetic materials
- Understand the dielectric and insulating materials
- Study about Optoelectronic and nano Electronic Materials

Course Outcomes: At the end of this course, learners will be able to:

- Choose elements with respect to atomic structures and bonding
- Analyze conducting materials
- Analyze semiconductor and magnetic materials
- Analyze the dielectric and insulating materials
- Analyze the optoelectronic and nano Electronic Materials

Unit I	INTRODUCTION	7

Structure: atomic structures and bonding, types of bonding, band formation. Defects and imperfections in solids: Point, Line and Planer defects; Interfacial defects and volume defects. Classification of materials based on bonding: conductors, semiconductors and insulators.

Unit II	CONDUCTING MATERIALS	9

Introduction, factors affecting the conductivity of materials, classification based on conductivity of materials, temperature dependence of resistivity, Low resistivity materials (graphite, Al, Cu and steel) and its applications, high resistivity materials (manganin, constantin, nichrome, tungsten) and their applications. Superconductors: Meissner effect, classification and applications.

Unit III	SEMICONDUCTING AND MAGNETIC MATERIALS	10

Semiconductors: Introduction, types of semiconductors, temperature dependence of semiconductors, compound semiconductors, basic ideas of amorphous and organic semiconductors. Magnetic Materials: classification of magnetic materials, ferromagnetism-B-H curve (Qualitative), hard and soft magnetic materials, magneto materials applications.

Unit IV	DIELECTRIC AND INSULATING MATERIALS	9

Dielectric Materials: Introduction, classification, temperature dependence on polarization, properties,dielectric loss, factors influencing dielectric strength and capacitor materials, applications. Insulators: Introduction, thermal and mechanical properties required for insulators, Inorganic materials, organic materials, liquid insulators, gaseous insulators and ageing of insulators, applications.

Unit V	OPTOELECTRONIC ANDNANO ELECTRONIC MATERIALS	10

Optoelectronic materials. Introduction, properties, factor affecting optical properties, role of optoelectronic materials in LEDs, LASERs, photodetectors, solar cells. Nano electronic Materials: Introduction, advantage of nanoelectronic devices, materials, fabrication, challenges in Nano electronic materials.

TEXT BOOK(S):

1. S.O. Kasap "Principles of Electronic Materials and Devices", 3rd edition, McGraw-Hill Education (India) Pvt. Ltd., 2007.
2. W D Callister, "Materials Science & Engineering An Introduction", Jr., John Willey & Sons, Inc, New York, 10th edition, 2020.

REFERENCE(S):

1. B.G. Streetman and S. Banerjee, Solid State Electronic Devices, 6th edition, PHI Learning, 2009.
2. Wei Gao, Zhengwei Li, Nigel Sammes, An Introduction to Electronic Materials for Engineers, 2nd Edition, World Scientific Publishing Co. Pvt. Ltd., 2011

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Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester-VI	OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ECY06	BIO MEDICAL INSTRUMENTATION	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Learn Electro-Physiology and Bio-Potential Recording
- Study Bio medical and non electrical parameter measurement
- Learn about Assist Devices and Bio-Telemetry
- Understand the concepts of Radiological Equipment
- Aware of the recent trends in Medical Instrumentation

Course Outcomes: At the end of this course, learners will be able to:

- Apply Electro-Physiology and Bio-Potential Recording
- Perform Bio medical and non electrical parameter measurement
- Apply Assist Devices and Bio-Telemetry
- Use Radiological Equipment
- Apply recent trends in Medical Instrumentation

Unit I	ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING	9

The Origin of Bio-potentials: bio potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG,EOG, lead systems and recording methods-typical waveform and signal characteristics.

Unit II	BIO- CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT	9

PH, PO2, PCO2, PHCO3, Electrophoresis, colorimeter, photometer, Auto analyzer, Blood flow meter, cardiac output, respiratory measurement, Blood pressure, temperature, pulse, Blood cell counters

Unit III	ASSIST DEVICES AND BIO-TELEMETRY	9

Cardiac pacemakers, Heart-Lung Machine, DC defibrillator, Dialysis, Telemetry principles, frequency selection, Bio-telemetry, radio-pill and tele-stimulation.

Unit IV	RADIOLOGICAL EQUIPMENTS	9

Ionizing radiation, Diagnostic x-ray equipments, use of Radio Isotope in diagnosis, Multi section Radiography, plane of movement-Radiation Therapy.

Unit V	RECENT TRENDS IN MEDICAL INSTRUMENTATION	9

Thermograph, endoscopy unit, Lasers in medicine, Diathermy units, Electrical safety in medical equipment- Patient monitoring system.

TEXT BOOK(S):

1. Leislie Cromwell, Bio medical Instrumentation and Measurement, PHI, 2015.
2. David Prutchi and Michael Norris, Design and Development of Medical Electronic Instrumentation: A Practical perspective of the design construction and test of Medical Device, 2005.

REFERENCE(S):

1. RS Khandpur, Hand book of Bio medical Instrumentation, Tata McGraw-Hill, 2005.
2. Joseph J. Carr and John M. Brown, Introduction to Bio medical equipment Technology, John Wiley, 2004.

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Dept.of ECE - ESEG

Department	ELECTRONICS AND COMMUNICAYION ENGINEERING				R 2019	Semester-VI	OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ECY07	SENSORS FOR ENGINEERING APPLICATIONS	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Learn Electro-Physiology and Bio-Potential Recording
- Understand Motion Sensors
- Study about photo transistors and photovoltaic devices
- Learn about Thermocouples and thermistors
- Understand Electronic sensors

Course Outcomes: At the end of this course, learners will be able to:

- Convert a physical parameter into an electrical quantity
- Apply motion Sensors
- Use photo transistor / Photovoltaic devices
- Design Thermocouples and thermistors
- Use electronic sensors dependent on applications

Unit I	ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING	9

Resistance strain guage, piezoelectric pressure gauge, characteristics. Electronic circuits for strain gauge, load cells. Interferometer, Fibre-optic methods. Pressure gauges Aneroid capacitance pressure gauge, ionization gauge, Using the transducers for applications.

Unit II	MOTION SENSORS	9

Capacitor plate sensor, Inductive sensors, LVDT Accelerometer systems, rotation sensors drag cup devices, piezoelectric devices. Rotary encoders.

Unit III	LIGHT RADIATION	9

Color temperature, light flux, photo sensors, photomultiplier, photo resistor and photoconductors, photodiodes, phototransistors, photovoltaic devices, fiber-optic applications, light transducer, solid-state ,transducers liquid crystal devices.

Unit IV	HEAT AND TEMPERATURE	9

Bimetallic strip, Bourdon temperature gauge, thermocouples, Resistance thermometers, thermistors, PTC thermistors, bolometer, Pyroelectric detector.

Unit V	ELECTRONIC SENSORS	9

Proximity detectors – Inductive and capacitive, ultrasonic, photo beam detectors Reed switch, magnet and Hall-effect units, Doppler detectors, liquid level detectors, flow sensors, smoke sensors.

TEXT BOOK(S):

1. Doebelin E O, Measurement Systems, Application and Design , McGraw Hill, Fifth Edition, 2007.
2. Ian R Sinclair, Sensors and Transducers, Third Edition, Newnes publishers, 2001.

REFERENCE(S):

1. Jack P Holman, Experimental Methods for Engineers, 8th Edition, McGraw Hill, USA, 2012.
2. Rees G. Physical principles of remote sensing,3rd edition, Cambridge University Press 2012
3. https://www.scribd.com/doc/233973017/Remote-Sensing-and-Image-Interpret-T-M-Lillesand

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester-VI	OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECY08	PRINCIPLES OF DIGITAL IMAGE PROCESSING	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Learn about the basic concepts of Digital Image Processing
- Familiarize with the Image Enhancement Techniques.
- Learn about Image restoration and multiresolution analysis
- Study Image segmentation and feature Extraction
- Understand applications of Image Processing.

Course Outcomes: At the end of this course, learners will be able to:

- Implement basic Image Processing Operations.
- Apply Image Enhancement Techniques.
- Extract features from Images with wavelet Transforms and image restoration Techniques
- Apply Image segmentation and feature Extraction
- Design and develop a real time system with image processing techniques

Unit I	FUNDAMENTALS OF IMAGE PROCESSING	9

Introduction–Applications of Image Processing – Steps in Image Processing Applications – Digital Imaging System – Sampling and Quantization – Pixel Connectivity – Distance Measures – Colour Fundamentals and Models – File Formats, Image Operations.

Unit II	IMAGE ENHANCEMENT	9

Image Transforms: Fast Fourier Transform and Discrete Fourier Transform – Image Enhancement in Spatial and Frequency Domain – Grey level Transformations–Histogram Processing – Spatial Filtering – Smoothing and Sharpening – Filtering in Frequency Domain.

Unit III	IMAGE RESTORATION AND MULTI-RESOLUTION ANALYSIS	9

Multi Resolution Analysis: Image Pyramids – Multi Resolution Expansion – Wavelet Transforms–Image Restoration–Image Degradation Model–Noise Modelling – Blur – Order Statistic Filters–Image restoration Algorithms.

Unit IV	IMAGE SEGMENTATION AND FEATURE EXTRACTION	9

Image Segmentation – Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region based Segmentation –Image Features and Extraction–Image Features– Types of Features–Feature Extraction–SIFT, SURF and Texture–Feature Reduction Algorithms.

Unit V	IMAGE PROCESSING APPLICATIONS	9

Image Classifiers – Supervised Learning – Support Vector Machines, Image Clustering – Unsupervised Learning – Hierarchical and Partition Based Clustering Algorithms – EM Algorithm – Case Studies in Biometrics – Iris, Fingerprint and Face Recognition – Case Studies on Image Security – Steganography and Digital Watermarking – Case Studies on Medical Imaging and Remote Sensing.

TEXT BOOK(S):

1. Rafael Gonzalez, Richard E. Woods, "Digital Image Processing", Fourth Edition, Pearson Education, 2018.
2. S. Sridhar, "Digital Image Processing", Second Edition, Oxford University Press, 2016.

REFERENCE(S):

1. Kenneth R. Castleman, Digital Image Processing', Pearson, 2006
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis and Machine Vision", Second Edition, Thompson Learning, 2007.
3. D,E. Dudgeon and RM. Mersereau, Multidimensional Digital Signal Processing', Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, Digital Image Processing', John Wiley, New York, 2002

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester -IV	OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19ECY09	DISCRETE TIME SIGNAL PROCESSING	3	0	0	3	45	100

Course Objective (s):

- Study the classification of signals and systems
- Understand the analysis of Discrete time Signal
- Learn IIR Filter Design
- Learn FIR Filter Design
- Understand finite word length effects

Course Outcomes: At the end of this course, learners will be able to:

- Analyze different types of signals and systems
- Analyze Discrete Time Signal
- Design a digital IIR filter from analog filter using suitable transformation techniques
- Design a digital FIR filter with different windowing techniques.
- Analyze the finite word length effects in real time signal processing applications

Unit I	SIGNALS AND SYSTEMS	9

Continuous and discrete time signals - Classification of Discrete time signals: Periodic and Aperiodic Even and Odd - Energy and Power signals - Deterministic and Random signals – Complex exponential and Sinusoidal signals - Periodicity - Analysis of Linear time invariant systems using Convolution.

Unit II	ANALYSIS OF DISCRETE TIME SIGNALS	9

Analysis of DT signals using Z- Transform -Properties of Z-transform - Inverse z-transform using Power Series expansion, Relationship between Z-transform and Fourier transform. Discrete Fourier Transform (DFT), FFT: Radix - 2 DIT and DIF algorithms,

Unit III	IIR FILTER DESIGN	9

Butterworth and Chebyshev approximations - Design of Discrete time IIR filter from continuous time filter - IIR filter design by Impulse Invariance method, Bilinear transformation method - Structure of IIR System.

Unit IV	FIR FILTER DESIGN	9

Linear phase filter - Symmetric and Anti-symmetric FIR filters - Windowing technique: Rectangular,Hamming, Hanning windows - Frequency sampling techniques - Structure for FIR systems:Direct form, Linear phase realization structure

Unit V	FINITE WORD LENGTH EFFECTS	9

Quantization noise - Over flow error - Truncation error - Limit cycle oscillation - Signal scaling - Interpolation and Decimation: Decimation by an integer factor - Interpolation by an integer factor - Sampling rate conversion by a rational factor

TEXT BOOK(S):

1. John G Proakis and Dimtris G Manolakis, Digital Signal Processing Principles, Algorithmsand Application, Fifth Edition, PHI/Pearson Education, 2013.
2. Michael J Roberts, Govind Sharma, Fundamentals of Signals and Systems, Second Edition,McGraw-Hill, 2010.

REFERENCE(S):

1. Alan V Oppenheim, Alan S Willsky and S Hamid Nawab, Signals and Systems, SecondEdition, PHI/Pearson Education, 2010
2. Vinay K Ingle, John G Proakis, Digital Signal Processing with Matlab, Third edition, Cengage Learning, 2011.

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Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019		OE
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECY10	Information and Coding Theory	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- To study the limits set by Information Theory
- To study the various waveform coding schemes
- To know the fundamentals of channel coding
- To Learn the concept of **Convolution Codes**
- To understand the essentials of Iterative Decoding

Course Outcomes: At the end of this course, learners will be able to:

- Comprehend probability and statistics in Information Theory.
- Evaluate the performance of source coding algorithms such as Huffman, Arithmetic and dictionary techniques.
- Analyze BER performance with block codes
- Analyze BER performance with convolution codes in AWGN.
- Evaluate the performance of the communication system with Iterative decoding in AWGN for Turbo codes and LDPC codes.

Unit I	Information Theory	9

Introduction – Discrete messages and Information content, Amount of Information, Average Information, Entropy, Information Rate, Mutual Information, Discrete memory less channel, Binary Symmetric Channel, Channel Capacity, Rate Distortion Theory, Lossy Source Coding.

Unit II	Source coding	9

Source Coding to increase average information per bit. Entropy coding, Huffman coding, Arithmetic coding, Shannon fano coding, Dictionary techniques, LZ77 and LZW techniques.

Unit III	Channel Coding	9

Channel capacity, Block codes, linear block codes, Hamming weight, Hamming bound, Maximum Likelihood (ML) detection, syndrome decoding, BCH and RS codes, Reed-Muller codes, soft-decision decoding algorithm and Network coding, Tradeoff between power and bandwidth.

Unit IV	Convolution Codes	9

Viterbi decoding, state diagrams, Trellis diagram, catastrophic encoders, soft-decision decoding, Product codes, Trellis coded modulation.

Unit V	Iterative Decoding	9

Turbo codes, constituent encoder, Interleaver, Soft information, Low-Density Parity Check (LDPC) codes, MAP algorithms.

TEXT BOOK(S):

1. T. M. Cover and J. A. Thomas, Elements of Information Theory, John Wiley.
2. S. Lin, D. J. Costello, Error Control Coding, Pearson Education.

REFERENCE(S):

1. T. K. Moon, Error Correction Coding: Mathematical Methods and Algorithms, John Wiley
2. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann.

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ONE CREDIT COURSE

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECZ01	SIMULATION TECHNOLOGIES FOR REAL TIME COMMUNICATION NETWORKS	1	0	0	1	15	100	

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To simulate the real time communication networks

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Simulate the real time communication networks

INTRODUCTION: Communication Network Modeling –simulation technologies, strategies and tools-languages-monte-carlo-– Queueing Models –Comparisons – Flexibility

SIMULATION & MODELING: Propagation Models – OSI Layer Modeling – Physical & MAC Layers – Higher Layer Protocols – Data Visualization and Interpretations – Simulation Parameters and Techniques – Protocols – Network Planning and Design – Model Output Analysis – Real Time Network Traffic Modeling

HANDS-ON TRAINING: Modeling and Simulation of Communication Networks: Construction, Parameter Settings, Analysis, Result Interpretation, Failure Analysis-Simulation using OPNET Riverbed Modeler 17.5 & QUALNET.

REFERENCE(S):

1	Mohammad S. Obaidat, Faouzi Zarai, Petros Nicopolitidis, Modeling and Simulation of Computer Networks and Systems: Methodologies and Applicationsǁ, Morgan Kaufmann, 2015
2	Al-Sakib Khan Pathan, Muhammad Mostafa Monowar, Shafiullah Khan, Simulation Technologies in Networking and Communications: Selecting the Best Tool for the Testǁ, CRC Press, 2014
3	Klaus Wehrle, Mesut Günes, James Gross, —Modeling and Tools for Network Simulationǁ, Springer, 2010
4	Jack L. Burbank, An Introduction to Network Modeling and Simulation for the Practicing Engineer, Wiley-IEEE Press, 2011

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks	
19ECZ02	HANDS ON COURSE IN EMBEDDED SYSTEMS	L	T	P	C	15	100	
		1	0	0	1			

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects. To train the hands on in embedded systems

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Train the hands on in embedded systems

INTRODUCTION

Embedded systems –introduction –Outline view- Block diagram-explanation-Identification of major blocks-sensors-actuators-controlling unit-Power supply-Algorithms (Intelligence). Identification of micro controller-Microcontroller vs Microprocessor-definition of Microcontroller-Features available- Atmega controller-Advantage and Disadvantage. Introduction to GPIO, ADC, Counter, Timer, Serial Communication Introduction to embedded C

INPUT/ OUTPUT CONTROL

Register used in GPIO- Explanation-framing code Sequence-input output control
Hands on 1: LED blinking control (output)
Hands on 2: LED Blinking pattern Development (output)
Hands on 3: Input Controlled LED Blinking

ANALOG /DIGITAL DATA PROCESING

Analog and Digital- Definition –Difference –Application-Mechanism of ADC-Registers- identification – explanation- Coding sequence of ADC
Hands on 4: Implementing ADC through POT
Hands on 5: POT controlled LED Blinking pattern Development

ACTUATOR CONTROL

Actuator –purpose- types of actuator –method of excitation –pros and cons of various actuators- need for driver-logic need for driver -mechanism behind drive-
Hands on 6: DC motor control through Micro controller
Hands on 7: Motion Development with Motor
Hands on 8: POT controlled Motion Development

SERIAL COMMUNICATION

Serial communication –Introduction –Working Mechanism- Concept of Interrupt- Need for Interrupt-Theory-method of sending – Coding Sequence
Hands on 9: LED blinking control through serial communication
Hands on 10: Controlling through keyboard

SENSOR INTERFACING

Sensor introduction –classification – analog and digital sensors-interfacing with microcontroller
Hands on 11: Interfacing Ultrasonic sensor with microcontroller.
Hands on 12: Controlling through keyboard

LCD DISPLAY

LCD display- working Mechanism-types of display-connection Procedure- Coding sequence Hands on 13: writing the names on the LCD Display
Hands on 14: viewing and monitoring various parameter like temperature.

REFERENCE(S):

1	Programming Embedded Systems: With C and GNU Development Tools, 2nd Edition,by Michael Barr and Anthony Massa.
2	Designing Embedded Hardware, 2nd Edition (link is external), by John Catsoulis
3	Beginning Arduino Michael McRoberts
4	Arduino Cookbook by Michael Margolis
5	Getting Started with Arduino Massimo Banzi

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours /Week			Credit	Total Hours	Maximum Marks	
19ECZ03	INTERNET OF THINGS (IoT) USING CC3200	L	T	P	C	15	100	
		1	0	0	1			

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To gain the knowledge on IoT using CC3200

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Gain the knowledge on IoT using CC3200

OVERVIEW

Introduction to Internet of Things (IoT). Review of CC3200 core and its architecture, Introduction to advanced ARM Cortex M4 architecture, Peripherals overview, User API, Power challenges with IoT, CC3200 Simplelink applications, Starting with Code Composer Studio V6.

SIMPLELINK WI-FI CPU

Introduction to CC3200 Simplelink Wi-Fi MCU, hardware Functional Block Diagram, Embedded Software Overview, TI-RTOS support for CC3200 Simplelink, TI-RTOS configuration for CC3200 Simplelink, Simplelink Wi-Fi certification, Power Modes.

WLAN CONNECTION

Introduction to WLAN, WLAN parameters, AP/STATION modes and its Security types, Socket connection, Typical commends and event flow, WLAN AP and WLAN STATION configuration settings.

SOFTWARES

Introduction to Pin-Mux Tool, Configuration with Pin-Mux Tools, Introduction to Uniflash, Debugging with Uniflash Tools, HTML page Download.

HANDS-ON WITH CC3200

Brief introduction to CC3200 Peripherals, OUT OF BOX demo, Home and Industrial automation and control, Creating project0, programming with ADC, Programming with GPIO, enabling interrupt, Introduction to serial interface, Overview of sensor interface with CC3200, TI RTOS configuration in CCS workspace, Client severer model basics, Simple Email application, Emailing an sensor (ADC) value.

REFERENCE(S):

1	Jonathan W Valvano, Introduction to ARM(r) Cortex -M Microcontrollers, 2012.
2	Andrew Sloss, Dominic Symes,Chris Wright, ARM System Developer's Guide,2004.
3	Datasheet, Technical Documents and Application Notes http://www.ti.com/product/CC3200

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECZ04	ADVANCED MOTOR CONTROL APPLICATION USING 32 BIT REAL TIME CONTROLLERS	1	0	0	1	15	100	

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To study the advanced motor control application using 32 bit real time controllers

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Study the advanced motor control application using 32 bit real time controllers

OVERVIEW

Over view of INSTASPIN, Advantages of using INTASPIN, Architecture of INSTASPIN, Introduction to MotorWare, Types of MotorWare, Advantages of using MotorWare, Implementation of INSTASPIN in Microcontrollers, overview of INSTASPIN based microcontrollers

BLDC MOTOR

Introduction to Motors, Various Types of Motors, Introduction to BLDC Motors, Commutation of BLDC motors, Sensor less BLDC Motors, Control of BLDC motors.

MOTOR CONTROL DRIVER

Introduction to motor drivers, Types of Motor Drivers, Advantages of using Motor Drivers, Implementation of Motor Drives, Design consideration for motor drivers usage of Digital Signal Controllers in motor control.

REAL TIME IMPLEMENTATION

Design Consideration for implementing Motor Control Application, Hardware Flow, Software Flow, and Implementation of INSTASPIN in software, Coding Standards, Real time control of BLDC Motors.

REFERENCE(S):

1	Hamid Toliyat and Steven Campbell, DSP BASED ELECTROMECHANICAL MOTION CONTROL, CRC Press.
2	Sen M. Kuo and Woon-Seng Gan , DIGITAL SIGNAL PROCESSORS - ARCHITECTURES, IMPLEMENTATIONS, AND APPLICATIONS, Prentice Hall.
3	Chang-liang Xia, Permanent Magnet Brushless DC Motor Drives and Controls, WILEY Publications.
4	C2000 Teaching ROM CD.
5	Datasheet, Technical Documents and Application Notes: http://www.ti.com/product/tms320f28335.
6	User Guide and Software Codes: http://www.ti.com/tool/tmdsprex28335
7	Code Composer Studio v6:
8	http://processors.wiki.ti.com/index.php/Category:Code_Composer_Studio_v6

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECZ05	ADVANCE SYSTEM DESIGN USING 16BIT ULTRA LOW POWER MICROCONTROLLERS	1	0	0	1	15	100	

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To design the advance systems using 16bit ultra low power microcontrollers

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Design the advance systems using 16bit ultra low power microcontrollers

OVERVIEW

Review of 16Bit Ultra Low Power Microcontrollers, Introduction to Advanced architecture of 16Bit Ultra Low Power Microcontrollers, clock module configuration, various frequency settings, Introduction to IDE, compiler and linker file configuration, interfacing the IDE and HW development board.

DISPLAY INTERFACE

Types of LCD Display, Advantages of LCD Display, and Introduction to Dot matrix display, Character Formation, Pixel density, Implementation for 102x64 dot-matrixes LCD Interface.

SENSOR

Introduction to sensors, Types of Sensors, Need for Integration of sensors, Analog Front end Introduction , Introduction to Temperature Sensor, Implementation of Temperature Sensors, Introduction to Capacitive Touch Sense, Advantages of using capacitive touch sensors. Interfacing with 16Bit Ultra Low Power Microcontrollers.

MEMORY

Introduction to memory, various types of memory, Introduction to SD Card, Advantages of using SD card, Types of SD Cards , Interfacing SD Card with 16bit ultra low power controller

SERIAL INTERFACE

Types of Serial Interface, Advantages of using serial interface, Comparisons between various serial communication standards, Introduction to USB, Types of USB Interfacing Standards, Modes of Interfacing.

REFERENCE(S):

1	John H. Davies, MSP430 Microcontroller Basics, 2013.
2	Chris Nagy, Embedded Systems Design Using the TI MSP430 Series, 2013.
3	MSP430 Teach ROM CD.
4	Datasheet, Technical Documents and Application Notes: http://www.ti.com/product/msp430F5529.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECZ06	ADVANCED ANALOG SYSTEM DESIGN	1	0	0	1	15	100	

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To study the advanced analog system design

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Study the advanced analog system design

AUTOMATIC VOLUME CONTROL (AVC):

Introduction –Circuit and Description-Need for AVC-Applications-Benefits.

DC-DC CONVERTER

Introduction-conversion methods- Circuit and Description-Applications.

LOW DROPOUT REGULATOR (LDO):

Brief theory and description-Need for LDO- Comparison-Specifications-Applications- Introduction to webench.

LAB EXPERIMENTS

DESIGN OF AUTOMATIC VOLUME CONTROL

Obtain transfer characteristics

DESIGN OF DC-DC CONVERTERS

Simulation

Obtain time response

Obtain transfer function

Implementation

Obtain time response using hardware

Obtain transfer function using hardware

DESIGN OF LOW DROPOUT REGULATOR

Simulation

Obtain output characteristics

Transfer characteristics

Measure rippled rejection

Design of LDO using webench

Implementation

Obtain output characteristics using hardware

Transfer characteristics

Measure rippled rejection

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
19ECZ07	HANDS ON COURSE IN PCB DESIGNING USING PROTEL (ALTIUM DESIGNER), PADS TOOL	L	T	P	C	15	100	
		1	0	0	1			

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To train the hands on in PCB designing using protel (Altium Designer), PADS tool

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Train the hands on in PCB designing using protel (Altium Designer), PADS tool

1. Introduction
2. PCB Design Flow
3. Understanding the Make-Up of a PCB Design
    - Board Outline
    - Creating Copper Routes
    - Drilling Holes
    - Components on a PCB Design
    - Gerber Files

High speed, multi-layer digital PCB designs, Low-level analog PCB designs, Printed antenna designs, Complete assembly drawings, In-Circuit Test data generation, Pick and place data generation, Drill, panel, and cutout drawings, Professional fabrication documents, Autorouting for dense PCB designs

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
19ECZ08	FOUNDATION COURSE IN COMMUNITY RADIO TECHNOLOGY	L	T	P	C	15	100	
		1	0	0	1			

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To gain the knowledge on foundation course in community radio technology

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Gain the knowledge on foundation course in community radio technology

INTRODUCTION TO COMMUNITY RADIO

Evolution of Community Radio (CR) in India- principles behind setting up of CR- policy guidelines and their impact on technology and content of a CR station- fundamental principles behind deciding the technology for a CR station.

STUDIO TECHNOLOGY

Properties and components of sound-difference between analogue and digital audio-hardware required for field recording and setting up a studio-fundamental principles for setting up an audio studio.

AUDIO PRODUCTION

Concept of recording and storing audio-hardware related to audio recording-open source software solutions for audio production- telephony interfaces for radio- audio Post Production.

STUDIO OPERATIONS

Wiring, fixing of connectors, soldering and use of tools and equipment- preventive and corrective maintenance of studio and equipment.

RADIO TRANSMISSION TECHNOLOGY

Components of the FM transmission chain- FM transmitter-different types of FM antenna - coaxial cable propagation and coverage of RF signals-FM transmitter setup

REFERENCE(S):

1	UNESCO (2001). Community Radio Handbook.
2	Vinod Pavarala, Kanchan K Malik, "Other Voices: The Struggle for Community Radio in India", SAGE Publications India,2007.
3	Steve Buckley, Mark Raboy, Toby Mendel, Kreszentia Duer, Monroe E. Price, Seán Ó Siochrú, "Broadcasting, Voice, and Accountability: A Public Interest Approach to Policy, Law, and Regulation", University of Michigan Press, 2008.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECZ09	LTE AND THE EVOLUTION TO 4G WIRELESS COMMUNICATIONS	1	0	0	1	15	100	

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To gain the knowledge on LTE and the evolution to 4G wireless communications

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Gain the knowledge on LTE and the evolution to 4G wireless communications

LTE: Motivation to LTE.- Evolution of Architecture –3GPP with Non-3GPP Architecture- EPC - eNB, HeNB and Relay Nodes -LTE-Advanced LTE Protocol Stacks Summary- Protocol architecture - S1 and X2 Interface, Other interfaces- Security Architecture -MBMS Architecture -CS FallBack, SRVCC, VoLTE –Advantages of LTE.

PHYSICAL LAYER: Uplink Physical Layer Design – Downlink physical layer design

CONTROL PLANE AND USER PLANE PROTOCOLS: MAC architecture- DL-SCH data transfer- HARQ operation- Multiplexing and assembly- Scheduling Request - RLC architecture - PDCP architecture. Radio Resource Controller – PLMN and cell selection, Paging.

CALL PROCESSING PROCEDURES: Idle Mode Processing - Cell Reselection- Paging- RRC Connection and Release- SON- Handover - Intra RAT and Inter-RAT

REFERENCE(S):

1	Stefania Sesia, Issam Toufik and Matthew Baker, LTE – The UMTS Long Term Evolution: From Theory to Practicell, Second Edition, John Wiley & Sons,2011.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECZ10	MILLIMETER WAVE COMMUNICATION NETWORKS	1	0	0	1	15	100	

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To gain the knowledge on millimeter wave communication networks

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Gain the knowledge on millimeter wave communication networks

INTRODUCTION TO MULTI-GIGABIT: 60-Ghz Millimeter wave radios-Millimeter wave characteristics-Channel performance at 60GHz, Gigabit wireless communication, Standards-Wi -Gig, IEEE 802.11ad, IEEE 802.15.3c,WirelessHD,ECMA-387/ISO/IEC 13156-Millimeter wave applications.

MILLIMETER WAVE ANTENNAS: Path loss and antenna directivity-Antenna beamwidth-Maximum possible gain to Q-Polarization, Beam steering antenna-Millimetre wave design consideration

MILLIMETER WAVE TRANSCEIVERS: Millimeter wave link budget-Transceiver architecture-Receiver without local oscillator, Millimeter wave calibration

MILLIMETER WAVE MIMO: Spatial diversity of antenna arrays-Multiple antennas, Multiple transceivers-Noise coupling in MIMO system.

REFERENCE(S):

1	Kao-Cheng Huang, Zhaocheng Wang, Millimeter wave communication systems,John Wiley & Sons, Hoboken, New Jersey, 2011.
2	Jonathan Wells, Multi-Gigabit Microwave and Millimeter-Wave Wireless Communications, Artech House, 2010.
3	Su-Khiong Yong, Pengfei Xia and Alberto Valdes-Garcia, 60GHz Technology for Gbps WLAN and WPAN: From Theory to Practicell, Wiley 2010.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECZ11	FIBER OPTIC CABLE INSTALLATION AND OTDR TESTING	1	0	0	1	15	100	

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To learn the fiber optic cable installation and OTDR testing

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Learn the fiber optic cable installation and OTDR testing

FIBER CABLE CHARACTERISTICS:

Structure-OFC Components-Strength Member-Outer and Inner Jacket-Loose Tube- Tight Buffer ADSS- Ariel-Cable-Direct- Burried Cable-Indoor-Outdoor-Cable-Types - Cable marking and packaging requirements

OPTICAL FIBER CABLE LAYING PROCEDURE:

Polyvinyl chloride/ High Density Polyethylene- type of pipes; Horizontal Directional Drilling (HDD), Route Index Diagram; Brick Chamber Type Hand Hole; Technical Specifications. Duct Laying; High Density Poly Ethylene (HDPE) telecom ducts- 140-40-15-Manhole Design Aspects;190-130-30-RCC-manhole.

FIBER TESTING:

Optical Time Domain Reflectometer -OTDR-light Source- power meter- Fiber continuity-Attenuation-Fiber length- preparation of a mechanical splice – evaluation of spice joints by EIA/TIA 568B3 standard using an OTDR - Thermo shrinking.

REFERENCE(S):

1.	Palais J.C, "Fiber optic Communications" Fifth Edition, Pearson Education, 2011
2.	Gerd Keiser, "Optical Fiber Communication", 4th Edition, Tata McGraw Hill, 2010.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECZ12	RTOS AND ITS APPLICATIONS	1	0	0	1	15	100	

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To gain the knowledge on RTOS and its applications

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Gain the knowledge on RTOS and its applications

INTRODUCTION: Real Time System Concepts. Comparison between conventional OS and RTOS. Introduction to MQX RTOS. When to use which OS, RTOS, RTS and Standalone, Different Modules of RTOS. Process management details.

RTOS Lab#1: Code Warrior of Free-scale, Hardware board environment, BSP, PSP, Application differentiations, host machine setups, project configurations for RTOS. Task creations. Priority settings, working with different scheduler algorithms. To understand different states of a job.

INTER PROCESS COMMUNICATION BASICS: Semaphores, Messages.

RTOS Lab#2: IPC Basics hands on sessions

INTER PROCESS COMMUNICATION ADVANCED: Priority inversion, Priority inheritance, Dead Lock, Mail box, Events, Mutex

RTOS Lab#3: Priority Inversion, Priority inheritance, Dead lock

DEVICE DRIVERS: Device Driver basics, MQX Device Drivers, MQX Device Driver Application Programming,

REFERENCE(S):

1	Operating Systems By Silberschatz, Galvin, Gagne
2	Micro C/OS-II The Real-Time Kernel, By Jean J. Labrosse
3	Freescale MQX RTOS Manual.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECZ13	TELEMATICS	1	0	0	1	15	100	

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To impart the knowledge telematics

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Impart the knowledge telematics

INTRODUCTION: Introduction to 16Bit Ultra Low Power Microcontroller - CPU Architecture, Basic Block Diagram, Clock Module Overview, clock module configuration, various frequency settings, Introduction to IDE, compiler and linker file configuration, Interfacing the IDE and HW development board.

PERIPHERALS INTERFACING: Introduction to digital peripherals - Introduction to Input / Output Ports - Configuration of Digital ports as Input and Output - Introduction to Low Power Modes - Various Low power mode of operations and settings.
Communication Peripherals – Universal Asynchronous Serial Transmission (UART) – Baud rate – Register Configuration –Transmission and Reception of Data between MCU and PC

TELEMATICS APPLICATIONS: Overview of Global System for Mobile Communication – Operation – Introduction to AT commands – Send Message using Serial Terminal. Overview of Global Positioning System – Introduction to NMEA Protocol – GPS Co-Ordinates – Monitoring GPS Data over Serial Terminal

INTERFACING GSM WITH LOW POWER MCU: MCU – Configuration of UART - Hardware Interfacing of GSM with MCU –Send Message using AT commands

INTERFACING GPS WITH LOW POWER MCU: MCU – Configuration of UART – Hardware Interfacing of GPS with MCU – GPS Position Fix with Indication in LED. Send Alert SMS with observed GPS Position Change.

REFERENCE(S):

1	John H. Davies, MSP430 Microcontroller Basics, Newnes Publication, 2010.
2	Chris Nagy, Embedded Systems Design Using the TI MSP430 Series‖, 2013, MSP430 Teaching ROM CD.
3	Sim900 AT COMMANDS, SIMCOM Ltd.
4	Klaus Betke, The NMEA 0183 Protocol‖, May 2000.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECZ14	ADVANCED VERIFICATION METHODOLOGIES	1	0	0	1	15	100	

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To gain the knowledge on advance verification methodologies

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Gain the knowledge on advance verification methodologies

SYSTEM VERILOG FOR VERIFICATION: Data types – Function and task - Basic OOP – Class Methods – Handling objects – Public and local variables.

SYSTEM LEVEL VERIFICATION ENVIROMENT AND COMPONENTS: Basic component in Verification -- Driver – Stimulus generator – Monitor – Scoreboard – Checker -- Creating test bench.

STIMULUS – COVERAGE AND ASSERTIONS: Generating different type of stimulus – Constrained Random Stimulus generation – Directed stimulus Generation -- Coverage Driven Simulation – Assertion based Simulation.

INTRODUCTION TO OVM: Introduction to OVM - OVM class and its hierarchy – OVM test bench and environment – Basics of Transaction-Level Modeling (TLM) – OVM components – Developing Reusable OVM Components

CASE STUDY: Sample architecture – Creating verification environment – Creating the test plan – Creating test case – Reusable - Transaction Level Models - Managing Simulations - Regression.

REFERENCE(S):

1	Janick Bergeron, Writing Test Benches Using System Verilog, Springer, 2009.
2	Mark Glasser, "Open Verification Methodology Cookbook", Springer, 2009.
3	Chris Spear and Greg Tumbush, "System Verilog for Verification - A Guide to Learning the Test bench Language Features" Springer, 2012.
4	OVM System Verilog User Guidell, Cadence Design Systems and Mentor Graphics, Version 2.0.2, June 2009.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECZ15	E-COMMERCE SECURITY	1	0	0	1	15	100	

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To learn the E-Commerce security

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Learn the E-Commerce security

INTRODUCTION: Introduction to e-Commerce - Infrastructure – Benefits, limitations - Security Threats, Vulnerabilities – Standards-IEEE.

SECURITY MECHANISMS: Legal issues – Cyber Crimes - key management and certificates - payment security services - communication network and network access layer security - Internet layer security and transport layer security - application layer security - hypertext transfer protocol - web server security - web client security, mobile code security - mobile agent security - mobile commerce security, digital signature certificates – eCards Security – mobile payment technology –Payment Card Industry Data Security Standard PCI / DSS.

HANDS-ON TRAINING: Modeling and design of a secure Web/Mobile based e-commerce application, securing internal network, and providing secure employee/user authentication.

REFERENCE(S):

1	Yun Zhao Chwan-Hwa (John) Wu and J. David Irwin, Introduction to Computer Networks and Cybersecurity, CRC Press; 1 edition, February 4, 2013.
2	Ghosh, Anup K., E-Commerce Security and Privacy, Kluwer Academic Publishers, 2001
3	Ford W Baum M, Secure Electronic Commerce: Building the Infrastructure for Digital Signatures and Encryptionll, Prentice Hall, New Delhi, 2001.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECZ16	ROUTING ARCHITECTURE AND DESIGN	1	0	0	1	15	100	

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To design the routing architecture

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Design the routing architecture

OVERVIEW:OSI and TCP/IP Models, explanation of each layer along with real time example, IP Addressing schemes, IPV4 and IPV6 evolution, LAN, WAN, MAN, Networking devices.

NETWORKING INFRASTRUCTURES AND DESIGNS: Discovering Network Design Basics, Network design overview, Benefits of hierarchical network design, Network design methodology.

ROUTING ARCHITECTURE: Cisco Routers and its types, Types of Routing protocols, Static Routing, Dynamic routing, RIP, OSPF, EIGRP, BGP, Routing Technologies– MPLS, L2VPN, L3VPN, IPSEC VPN.

NETWORKING PHASES: Planning & Design, Testing and Validation, Implementation and Deployment, Maintenance and change.

DEMO: Quick Demo with simulators on building Simple Network Topology-VLAN configurations, Static Routing, Any one routing protocol implementation.

REFERENCE(S):

1	Kevin Wallace, Cisco press, Routing and Switching Route 300 - 101 Official Cert Guide.
2	David Hucaby, Cisco press, Ccnp Routing and Switching Switch 300 - 115 Official Cert Guide.
3	3.http://www.cisco.com/c/en/us/td/docs/routers/crs/software/crs_r4-1/lxvpn/configuration/guide/vc41crs /vc41v2.pdf
4	http://www.ciscopress.com/articles/article.asp?p=2180210&seqNum=7

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Dept.of ECE - ESEC

Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester	-
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19ECZ17	EMBEDDED PROTOCOLS	1	0	0	1	15	100	

Course Objective (s): The student will be tested for his understanding of the basic principles of the core engineering subjects.

- To gain the knowledge on embedded protocols

Course Outcomes: At the end of this course, learners will be able to:

- Review, prepare and present technological developments
- Gain the knowledge on embedded protocols

COMMUNICATION PROTOCOLS

Serial & Parallel Communication, I2C Bus characteristics, Data Transfer, Interfacing & Programming I2C based EEPROM, Introduction to SPI protocol, Interfacing SPI based Graphic LCD Display Interface, Interfacing SPI based Touch Screen with Controller. Introduction to Serial Communication using UART, The Physical Layer Standards, Programming UART in MCU to Communicate with PC, UART based Password Authentication System, Introduction to CAN, CAN Frame Formats, CAN Frame Formats, Establishing CAN Communication network between two controllers, Introduction to Bluetooth, AT Commands for Bluetooth Communication, Introduction to ZigBee Protocol, Understanding the X-CTU Terminal & Configurations of ZigBee Nodes, ZigBee Based Home Automation.

REFERENCE(S):	
1	Reference manual will be provided by the industry

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Dept.of ECE - ESEC

LANGUAGE ELECTIVES

Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester II	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
19HX201	ENGLISH FOR ENGINEERS	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Acquire the usage of grammar in English language.
- Develop listening skills which will enable to listen lectures and comprehend different types of texts.
- Enhance the reading skill to comprehend technical writings.
- Improve writing skills to express thoughts freely.
- Develop speaking skills to speak fluently in real contexts.

Course Outcomes: At the end of this course, learners will be able to:

- Improve their language usage in LSRW skills.
- Develop listening skills to understand sentence stress and intonations.
- Acquire the ability to understand different written texts.
- Enhance the writing skills to express the ideas of the learners.
- Communicate fluently in pair / team.

Unit I	LANGUAGE FOCUS	9

Voice(Active & Passive) - Reported speech - Conditionals - Collocations - Discourse markers - One word substitution - Phrasal verbs - Error identification

Unit II	LISTENING	9

Listening for specific information – Identifying sentence stress - Rhythm - Intonation

Unit III	READING	9

Reading graphs and charts - Skimming and scanning texts – Identifying topic sentences - Understanding the structure of a text

Unit IV	WRITING	9

Job Application, Letter and Resume - Recommendations - Report writing (accident and survey) - Writing review (book and movie) - Transcoding (interpreting charts & diagrams)

Unit V	SPEAKING	9

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging - Language Functions: suggesting - comparing and contrasting - Expressing - finding out facts, attitudes and opinions

TEXT BOOK(S):

1.	Communicative English by KN Shoba ,Lourdes Joavani Rayen Published by Cambridge university Revised Edition 2018

REFERENCE(S):

1	Jeremy Comfort, Pamela Rogerson, Trish Stott, and Derek Utley, Speaking Effectively and Developing Speaking Skills for Business English, Cambridge: Cambridge University Press, 2002.
2	Eric H. Glendinning and Beverly Holmstrom, Study Reading: A Course In Reading for Academic Purposes. United Kingdom: Cambridge University Press, 2004.
3	Murphy, Raymond. English Grammar in Use – A Self-Study Reference and Practice Book For Intermediate learners Of English .Ived. United Kingdom: Cambridge University Press. 2012.
4	Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester II	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
19HX202	HINDI	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Help students to acquire the basics of Hindi
- Teach them how to converse in Hindi on various occasions
- Help learners acquire the ability to understand a simple technical text in Hindi

Course Outcomes: At the end of this course, learners will be able to:

- Communicate effectively with: (a) Improved fluency in Hindi (b) Clarity on the basic sounds of the Hindi language (c) Proper vocabulary

Unit I	HINDI ALPHABET	9

Genders (Masculine & Feminine Nouns ending in a ,e,i,o, u,)- Masculine & Feminine - Reading Exercises.

Introduction - Vowels - Consonants - Plosives - Fricatives - Nasal sounds - Vowel Signs - Chandra Bindu&Visarg -Table of Alphabet -Vocabulary.

Unit II	NOUNS IN HINDI	9

Genders (Masculine & Feminine Nouns ending in a ,e,i,o, u,)- Masculine & Feminine - Reading Exercises.

Unit III	PRONOUNS AND TENSES	9

Categories of Pronouns - Personal Pronouns - Second person (you & honorific) - Definite & Indefinite pronouns - Relative pronouns - Present tense - Past tense - Future tense - Assertive & Negative Sentences - Interrogative Sentences.

Unit IV	CLASSIFIED VOCABULARY	9

Parts of body - Relatives - Spices- Eatables- Fruit & Vegetables - Clothes - Directions-Seasons - Professions.

Unit V	SPEAKING	9

Model Sentences - Speaking practice for various occasions.

TEXT BOOK(S):

1.	Elementary Hindi: Learn to Communicate in Everyday Situations by Richard Delacy Tuttle Publication 2013
2	Colloquial Hindi: The Complete Course for Beginners by Tej K. Bhatia

REFERENCE(S):

1	B. R. Kishore, Self Hindi Teacher for Non-Hindi Speaking People, Vee Kumar Publications (P) Ltd., New Delhi, 2009
2	Syed, PrayojanMulak Hindi, RahamathullahVaniPrakasan, New Delhi, 2002
3	Ramdev, VyakaranPradeep, SaraswathiPrakasan, Varanasi, 2004.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING					R 2019	Semester II	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks	
		L	T	P	C			
19HX203	JAPANESE	3	0	0	3	45	100	

Course Objective (s): The purpose of learning this course is to

- Help students acquire the basics of Japanese language
- Teach them how to converse in Japanese in various occasions
- Teach the students the Japanese cultural facets and social etiquette

Course Outcomes: At the end of this course, learners will be able to communicate effectively with:

- Improved fluency in Japanese
- Clarity on the basic sounds of the Japanese language
- Proper vocabulary

Unit I	Introduction	9

Introduction to Japanese - Japanese script - Pronunciation of Japanese(Hiragana) - Long vowels - Pronunciation of in,tsu,ga - Letters combined with ya,yu,yo - Daily Greetings and Expressions Numerals. N1 wa N2 des - N1 wa N2 ja arimasen - S ka - N1mo - N1 no N2 - .san - Kanji - Technical Japanese Vocabulary (25 Numbers) - Phonetic and semantic resemblances between Tamil and Japanese

Unit II	Vocabulary & Grammar 語彙と文法	9

Introduction - Kore - Sore - are - Kono N1 - Sono N1 - ano N1 - so des - so ja arimasen - S1 ka - S2 ka - N1 no N1 - so des ka ' koko - soko - asoko - kochira - sochira - achira - N1 wa N2 (Place) des - dhoko-N1 no N2 - Kanji-10 - ima-.ji-fun des - Introduction of verb - V mas - V masen - V mashitha-V masen deshitha - N1(Time) ne V - N1 kara N2 des - N1 tho N2 / S ne Kanji-10 - Technical Japanese Vocabulary (25 Numbers) - Dictionary Usage.

Unit III	Noun & Types 名詞とタイプ	9

N1(Place) ye ikimas - ki mas - kayerimasu - Dhoko ye mo ikimasen - ikimasendheshitha - N1(vehicle) de ikimasu - kimasu - kayerimasu - N1(Personal or Animal) tho V ithsu - S yo. - N1 wo V (Transitive) - N1 wo shimus - Nani wo shimasu ka - Nan & Nani - N1(Place) de V - V masen ka - V masho - Oo. Kanji-10 , N1(tool - means) de V - Word / Sentence wa go nan des ka - N1(Person) ne agemus - N1(Person) ne moraimus - mo V shimashitha - , Kanji-10 - Japanese Typewriting using JWPCE Software, Technical Japanese Vocabulary (25 Numbers)

Unit IV	Vocabulary & Grammar 語彙と文法	9

Introduction to Adjectives - N1wanaadj des. N1 wa ii adj des - naadjna N1 - ii adj ii N1 - Thothemo - amari - N1 wadho des ka - N1 wadhonna N2 des ka - S1 ka S2 - dhore - N1 gaarimasu - wakarimasu - N1 ga suki masu - N1 gakiraimasu - jozu des - hetha des - dhonna N1 - Usages of yoku - dhaithai - thakusan - sukoshi - amari - zenzen - S1 kara S2 - dhoshithe, N1 gaarimasu - imasuN1(Place) ne N2 gaarimasu - iimasu - N1 wa N2(Place) ne arimasu - iimasu - N1(Person,Place,or Thing) no N2 (Position) - N1 ya N2, Kanji-10 - Japanese Dictionary usage using JWPCE Software, Technical Japanese Vocabulary (25 Numbers)

Unit V	Root Word & Vocabulary 語彙と語彙	9

Saying Numbers , Counter Suffixes , Usages of Quantifiers -Interrogatives - Dhonokurai - gurai - Quantifier-(Period) ne -.kai V - Quantifier dhake / N1 dhake Kanji - Past tense of Noun sentences and na Adjective sentences - Past tense of ii-adj sentences - N1 wa N2 yoriadj des - N1 tho N2 tho Dhochiragaadj des ka and its answering method - N1 [no naka] de {nani/dhoko/dhare/ithsu} ga ichiban adj des ka - answering -N1 gahoshi des - V1 mas form dhake mas - N1 (Place) ye V masu form ne ikimasu/kimasu/kayerimasu - N1 ne V/N1 wo V - Dhokoka - Nanika - gojumo - Technical

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Japanese Vocabulary (25 Numbers)	
TEXT BOOK(S):	
1.	Modern Japanese Vocabulary: A Guide for 21st Century Students | Edward P. Trimnell Publisher: Beechmont Crest Publishing .
2	Japanese Verbs & Essentials of Grammar" | Rita Lampkin Passport Books , 2013
REFERENCE(S):	
1	Japanese for Everyone: Elementary Main Textbook1-1 and 1-2, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.

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Department	ELECTRONICS AND COMMUNICATION ENGINEERING				R 2019	Semester II	BS
Course Code	Course Name	Hours / Week			Credit	Total Hours	Maximum Marks
		L	T	P	C		
19HX204	FRENCH	3	0	0	3	45	100

Course Objective (s): The purpose of learning this course is to

- Help students acquire the basics of French language
- Teach them how to converse in French in various occasions

Course Outcomes: At the end of this course, learners will be able to:

1. The students will become familiar with the basics of French language and start conversing in French.

Unit I	Alphabet Français	6

Alphabet Français (alphabets) - Les Accents Français (the accents in French) - aigu - grave - circonflexe - tréma cédille - écrire son nom dans le français (spellingone -sname in French) - Les noms de jours de la semaine (Days of the week)

Unit II	Numbers, month & year (Nombre, mois et année)	6

Les noms de mois de l'année (Months) - Numéro 1 à 100 (Numbers 1 to 100) GRAMMAIRE :Conjugaison

Unit III	Language Skills & Grammar (Compétences linguistiques et grammaire)	10

Moyens de transport (Transport) - Noms de Professions (Professions) - Noms d'endroits communs (Places) - Nationalités (Nationalities) ECOUTER : (Listening) Écouter I - alphabet associéà des prénoms français - Écouter et répondre PARLER (Speaking)Présntation - même /Présentez - Vous (Introducingoneself)LIRE :Lireles phrases simples

Unit IV	Grammar (et grammaire)	12

Pronoms (Pronouns) - Noms communs masculins et de femme (Common masculine and Femininenouns) - Verbes communs (Common verbs)COUTER :couter et crier les prnoms - Observer les dessins et couter les dialogues LIRE : Lire les profils d'utilisateurs d'interlingua (alter ego)PARLER :Parler de sa ville - Parler de sa profession

Unit V	Speaking & Writing (Parler et écrire)	11

Narration de son nom et l'endroit où on vit - Son âge et date de naissance - Numéro de téléphone et'dresse-Narration du temps - La France en Europe PARLER :Conversation entre deux amis - Jouer la scène ÉCOUTER :Ecouter les conversations (CD alter ego)ÉCRIRE :Écrireune carte postale

TEXT BOOK(S):

1.	Le Bon Usage by M. Grevisse Publisher- Duculot 14 edition (25 January 2001)
2	Advanced French by Monique L'Huillier, Cambridge University Press,2013

REFERENCE(S):

1	Alter ego+ Niveau a1
2	Grammaire Progressive du Français
3	Collins Easy Learning French Verbs& Practice
4	FrançaisLinguaphone
5	FrançaisI.Harrisonburg: The Rosetta Stone: Fairfield Language Technologies

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