K.L.N. COLLEGE OF ENGINEERING

Pottapalayam - 630612, Sivagangai District

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Estd: 1994

CURRICULUM AND SYLLABUS

I to VIII SEMESTERS

REGULATIONS 2020

For Under Graduate Program

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

CHOICE BASED CREDIT SYSTEM

(For the students admitted in the academic year 2021-2022)

Dr.V.KEJALAKSHMI
PROFESSOR & HEAD
DEPARTMENT OF ECE

K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM

(An Autonomous Institution, Affiliated to Anna University, Chennai)

VISION OF THE INSTITUTION

To become a Centre of Excellence in Technical Education and Research in producing Competent and Ethical professionals to the society.

MISSION OF THE INSTITUTION

To impart Value and Need based curriculum to the students with enriched skill development in the field of Engineering, Technology, Management and Entrepreneurship and to nurture their character with social concern and to pursue their career in the areas of Research and Industry**.**

VISION OF THE DEPARTMENT

To promote as a center of excellence in educational and research activities related to electronics and communication engineering and its allied areas.

MISSION OF THE DEPARTMENT

To create educational and research environment to meet ever changing and ever demanding needs of electronics and communication industry along with IT and other interdisciplinary fields.

To mould the students to become ethically upright and recognized as responsible engineers.

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: To prepare graduates with a strong foundation in Engineering science and Technology with more emphasis in Electronics and Communication Engineering and its allied areas.

PEO 2: To prepare the students to pursue successful career in industry and to motivate them for higher education.

PEO 3: To prepare the graduates to sustain as good professional, researcher and to practice them in emerging technologies through lifelong learning.

PEO 4: To impart students with ethical standards, professional excellence through effective communication skills, team work, multi disciplinary projects and social responsibility.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO 1: Design and analyse the basic analog and digital electronic circuits.

PSO 2: Design and analyse the spectral components of communication signals and systems.

PSO 3: Develop the modules in VLSI and embedded systems.

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PO1: Engineering knowledge
Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis
Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions
Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems
Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage
Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society
Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability
Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics
Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work
Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication
Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance
Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning
Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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REGULATIONS 2020

For Under Graduate Program

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

CHOICE BASED CREDIT SYSTEM

CATEGORY OF COURSES

i. **Humanities and Social Sciences / Management Elective (HS) Courses** include Technical English, Environmental Science and Engineering, Engineering Ethics, human values, Communication Skills, Total Quality Management etc.

ii. **Environmental Science and Engineering. Basic Sciences (BS**) **Courses** include Mathematics, Physics, and Chemistry.

iii. **Engineering Sciences (ES) Courses** include Engineering Practices, Engineering Graphics, Basics of Electrical / Electronics / Mechanical / Computer Engineering / Instrumentation etc.

iv. **Professional Core (PC) Courses** include the core courses relevant to the chosen programme of study.

v. **Professional Elective (PE) Courses** include the elective courses relevant to the chosen programme of study.

vi. **Open Elective (OE) Courses** include courses from other departments which a student can choose from the list specified in the curriculum of the students B.E. / B.Tech. Programmes.

vii. **Employability Enhancement Courses (EEC)** include Project Work and/or Internship, Seminar, Professional Practices, Case Study and Industrial/Practical Training.

viii. **Mandatory (MC) Courses** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc

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REGULATIONS 2020

CHOICE BASED CREDIT SYSTEM

(For the students admitted during the academic year 2021-2022)

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

I TO VIII SEMESTERS CURRICULUM AND SYLLABI

SEMESTER I

(Common to all B.E. / B.Tech Programmes)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20HS101	English for Technical Communication	HS	3	3	0	0	3
2.	20BS101	Fundamentals of Engineering Mathematics	BS	4	3	1	0	4
3.	20BS102	Engineering Physics	BS	3	3	0	0	3
4.	20BS103	Engineering Chemistry	BS	3	3	0	0	3
5.	20GE101	Problem Solving using Python Programming	ES	3	3	0	0	3
PRACTICAL								
6.	20BS1L1	Basic Science Laboratory	BS	3	0	0	3	1.5
7.	20GE1L1	Python Programming Laboratory	ES	4	0	0	4	2
8.	20GE1L2	Industrial Practices Workshop	ES	3	0	0	3	1.5
Total Credits								**21**

SEMESTER II

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20HS201	Advanced Technical Communication (Common to all B.E. / B.Tech programmes)	HS	3	3	0	0	3
2.	20BS201	Laplace Transform and Advanced Calculus (Common to all B.E. / B.Tech programmes)	BS	4	3	1	0	4
3.	20BS203	Physics for Electronics Engineering (Common to B.E. EEE & B.E. ECE programmes)	BS	3	3	0	0	3
4.	20EC201	Network Analysis	PC	4	3	1	0	4
5.	20GE201	Engineering Graphics (Common to all B.E. / B.Tech programmes)	ES	4	2	0	2	3
6.	20GE204	Basic Electrical Engineering and Electron Devices	ES	3	3	0	0	3
PRACTICAL								
7.	20EC2L1	Circuits and Devices Laboratory	PC	4	0	0	4	2
8.	20GE2L2	Unix and Shell Scripting Laboratory	ES	3	1	0	2	2
Total Credits								**24**

SEMESTER III

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20BS302	Linear Algebra and Partial Differential Equations	BS	4	3	1	0	4
2.	20EC301	Analog Circuits	PC	3	3	0	0	3
3.	20EC302	Signals and Systems	PC	4	3	1	0	4
4.	20EC303	Digital System Design	PC	4	3	1	0	4
5.	20HS301	Universal Human Values (Common to all B.E. / B.Tech programmes)	HS	3	2	1	0	3
THEORY CUM PRACTICAL								
6.	20CS303	Object Oriented Programming and Data Structures	ES	5	3	0	2	4
PRACTICAL								
7.	20EC3L1	Analog Circuits Laboratory	PC	3	0	0	3	1.5
8.	20EC3L2	Digital System Design Laboratory	PC	3	0	0	3	1.5
Total Credits								**25**

SEMESTER IV

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20EC401	Random Process and Information Theory	PC	3	3	0	0	3
2.	20EC402	Computer Architecture and Organization	PC	3	3	0	0	3
3.	20EC403	Electromagnetic Fields	PC	4	3	1	0	4
4.	20EC404	Analog Electronics and Integrated Circuits	PC	3	3	0	0	3
5.	20HS401	Environmental Science and Engineering (Common to all B.E. / B.Tech programmes)	HS	2	2	0	0	2
THEORY CUM PRACTICAL								
6.	20EC405	Principles of Digital Signal Processing	PC	5	2	1	2	4
PRACTICAL								
7.	20EC4L1	Analog Integrated Circuits Laboratory	PC	3	0	0	3	1.5
8.	20HS4L1	Professional Communication and Technical Presentation	EEC	3	0	0	3	1.5
Total Credits								**22**

SEMESTER V

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20EC508	Control System Engineering	PC	4	3	1	0	4
2.	20EC509	Transmission Lines and Wave Guides	PC	4	3	1	0	4
3.	20EC510	Analog and Digital Communication Techniques	PC	4	3	1	0	4
4.	20EC511	Microprocessor and Microcontroller Based Systems	PC	3	3	0	0	3
5.		Management Elective	HS	3	3	0	0	3
6.	20MC501	Constitution of India (Common to all B.E. / B.Tech programmes)	MC	1	1	0	0	-
THEORY CUM PRACTICAL								
7.	20EC505	Digital VLSI Design and FPGA Implementation	PC	5	3	0	2	4
PRACTICAL								
8.	20EC5L1	Communication Systems Laboratory	PC	3	0	0	3	1.5
9.	20EC5L4	Microprocessor and Microcontroller Based Systems Laboratory	PC	3	0	0	3	1.5
Total Credits								**25**

SEMESTER VI

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20EC604	Modern Antennas in Wireless Telecommunications	PC	4	3	1	0	4
2.		Professional Elective - I	PE	-	-	-	-	3
3.		Professional Elective - II	PE	-	-	-	-	3
4.		Professional Elective - III	PE	-	-	-	-	3
5.		Open Elective - I	OE	3	3	0	0	3
THEORY CUM PRACTICAL								
6.	20EC602	Communication Networks	PC	5	3	0	2	4
PRACTICAL								
7.	20EC6L1	Mini Project	EEC	4	0	0	4	2
Total Credits								**22**

SEMESTER VII

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	20EC705	Microwave and Optical Communications	PC	4	3	1	0	4
2.	20EC702	Wireless Communication	PC	3	3	0	0	3
3.		Professional Elective - IV	PE	-	-	-	-	3
4.		Professional Elective - V	PE	-	-	-	-	3
5.		Professional Elective - VI	PE	-	-	-	-	3
6.		Open Elective - II	OE	3	3	0	0	3
PRACTICAL								
7.	20EC7L1	Microwave and Optical Communication Laboratory	PC	4	0	0	4	2
Total Credits								**21**

SEMESTER VIII

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICAL								
1.	20EC8L1	Project Work	EEC	20	0	0	20	10
Total Credits								**10**

TOTAL NO. OF CREDITS: 170

PROFESSIONAL ELECTIVE (PE) : VERTICALS

Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V	Vertical VI
Semiconductor Chip Design and Testing	**RF and Wireless Communication Technologies**	**Signal Processing and Computer Vision**	**Artificial Intelligence and Machine Learning**	**Embedded and IOT**	**Biomedical and Sensor Technologies**
CAD for VLSI Circuits	Digital Communication Receivers	Speech Processing	Machine Learning and Applications	IoT Enabled Systems Design	Foundations for Nano Engineering
Multicore Programming	Satellite Communication	Advanced Digital Signal Processing	Artificial Intelligence for Everyone	Mixed C and Assembly Language Programming	Sensor Concepts and Techniques
System on Chip Design	RF Integrated Circuit Design	DSP Architecture and Programming	Fundamentals of Soft Computing	Embedded Processors	Human Assist Devices
VLSI Testing and Design for Testability	Wireless Broadband Networks	Text and Speech Analysis	Deep Learning	Robotics and Automation	Wireless Body Area Networks
Low Power IC Design	Advanced Wireless Communication	Digital Imaging and Computer Vision	Data Analytics	Industrial IoT and Industry 4.0	Biomedical Imaging Systems
Network on Chip Design	Radar Technologies	Software Defined Radio	Virtual Reality and Augmented Reality	Communicating Embedded Systems	Wireless Sensor Network Design
IC Fabrication Technology	Massive MIMO Networks	Video Analytics	Text and Speech Analysis	IoT Security	Brain Computer Interface and Applications
		Multimedia Compression Techniques	Ethics and AI		

Vertical I : Semiconductor Chip Design and Testing

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20ECV11	CAD for VLSI Circuits	PE	4	2	0	2	3
2.	20ECV21	Multicore Programming	PE	4	2	0	2	3
3.	20ECV31	System on Chip Design	PE	4	2	0	2	3
4.	20ECV41	VLSI Testing and Design for Testability	PE	3	3	0	0	3
5.	20ECV51	Low Power IC Design	PE	4	2	0	2	3
6.	20ECV61	Network on Chip Design	PE	3	3	0	0	3
7.	20ECV71	IC Fabrication Technology	PE	3	3	0	0	3

Vertical II : RF and Wireless Communication Technologies

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20ECV12	Digital Communication Receivers	PE	3	3	0	0	3
2.	20ECV22	Satellite Communication	PE	3	3	0	0	3
3.	20ECV32	RF Integrated Circuit Design	PE	3	3	0	0	3
4.	20ECV42	Wireless Broadband Networks	PE	3	3	0	0	3
5.	20ECV52	Advanced Wireless Communication	PE	3	3	0	0	3
6.	20ECV62	Radar Technologies	PE	3	3	0	0	3
7.	20ECV72	Massive MIMO Networks	PE	3	3	0	0	3

Vertical III : Signal Processing and Computer Vision

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20ECV13	Speech Processing	PE	3	3	0	0	3
2.	20ECV23	Advanced Digital Signal Processing	PE	4	2	0	2	3
3.	20ECV33	DSP Architecture and Programming	PE	4	2	0	2	3
4.	20ECV43	Text and Speech Analysis	PE	4	2	0	2	3
5.	20ECV53	Digital Imaging and Computer Vision	PE	4	2	0	2	3
6.	20ECV63	Software Defined Radio	PE	3	3	0	0	3
7.	20ECV73	Video Analytics	PE	3	3	0	0	3
8.	20ECV83	Multimedia Compression Techniques	PE	3	3	0	0	3

Vertical IV : Artificial Intelligence and Machine Learning

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20ECV14	Machine Learning and Applications	PE	4	2	0	2	3
2.	20ECV24	Artificial Intelligence for Everyone	PE	3	3	0	0	3
3.	20ECV34	Fundamentals of Soft Computing	PE	3	3	0	0	3
4.	20ECV44	Deep Learning	PE	3	3	0	0	3
5.	20ECV54	Data Analytics	PE	3	3	0	0	3
6.	20ECV64	Virtual Reality and Augmented Reality	PE	3	3	0	0	3
7.	20ECV43	Text and Speech Analysis	PE	4	2	0	2	3
8.	20ECV84	Ethics and AI	PE	3	3	0	0	3

Vertical V : Embedded and IOT

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20ECV15	IoT Enabled Systems Design	PE	4	2	0	2	3
2.	20ECV25	Mixed C and Assembly Language Programming	PE	4	2	0	2	3
3.	20ECV35	Embedded Processors	PE	4	2	0	2	3
4.	20ECV45	Robotics and Automation	PE	3	3	0	0	3
5.	20ECV55	Industrial IoT and Industry 4.0	PE	4	2	0	2	3
6.	20ECV65	Communicating Embedded Systems	PE	3	3	0	0	3
7.	20ECV75	IoT Security	PE	3	3	0	0	3

Vertical VI : Biomedical and Sensor Technologies

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20ECV16	Foundations for Nano Engineering	PE	3	3	0	0	3
2.	20ECV26	Sensor Concepts and Techniques	PE	3	3	0	0	3
3.	20ECV36	Human Assist Devices	PE	3	3	0	0	3
4.	20ECV46	Wireless Body Area Networks	PE	3	3	0	0	3
5.	20ECV56	Biomedical Imaging Systems	PE	3	3	0	0	3
6.	20ECV66	Wireless Sensor Network Design	PE	3	3	0	0	3
7.	20ECV76	Brain Computer Interface and Applications	PE	3	3	0	0	3

OPEN ELECTIVE - I (OE - I)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20OE102	Solid Free Form Manufacturing	OE	3	3	0	0	3
2.	20OE201	Fundamentals of Renewable Energy System	OE	3	3	0	0	3
3.	20OE202	Principles of Measurements and Instrumentation	OE	3	3	0	0	3
4.	20OE402	Introduction to Database Management Systems	OE	3	3	0	0	3
5.	20OE404	Cloud Infrastructure and Technologies	OE	3	3	0	0	3
6.	20OE501	Principles of Software Testing	OE	3	3	0	0	3
7.	20OE504	Cyber Security	OE	3	3	0	0	3
8.	20OE601	Fundamentals of Electric Vehicles	OE	3	3	0	0	3
9.	20OE602	Supply Chain Management	OE	3	3	0	0	3
10.	20OE703	Energy Conversion Techniques	OE	3	3	0	0	3

OPEN ELECTIVE - II (OE - II)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20OE108	Industrial Safety Practices	OE	3	3	0	0	3
2.	20OE205	Industrial Energy Auditing and Management	OE	3	3	0	0	3
3.	20OE406	Java Script Programming	OE	3	3	0	0	3
4.	20OE408	Essentials of Data Analytics	OE	3	3	0	0	3
5.	200E505	Information Security Essentials	OE	3	3	0	0	3
6.	20OE506	Principles of Cyber Physical Systems	OE	3	3	0	0	3
7.	20OE507	Concepts of Ethical Hacking	OE	3	3	0	0	3
8.	20OE608	Automotive Electrical and Electronics Systems	OE	3	3	0	0	3
9.	20OE708	Instrumentation for Agro Food Industry	OE	3	3	0	0	3
10.	20OE803	English for Research Paper Writing	OE	3	3	0	0	3

MANAGEMENT ELECTIVE

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20HS5A1	Management Concepts and Organizational Behaviour	HS	3	3	0	0	3
2.	20HS5A2	Industrial Marketing	HS	3	3	0	0	3
3.	20HS6A1	Intellectual Property Rights	HS	3	3	0	0	3
4.	20HS6B1	Project Management and Entrepreneurship	HS	3	3	0	0	3
5.	20HS7A2	Total Quality Management	HS	3	3	0	0	3
6.	20HS8A1	Human Relations at Work	HS	3	3	0	0	3
7.	20HS8B2	Economics for Engineers	HS	3	3	0	0	3

OPEN ELECTIVE - I (VI SEMESTER) - offered to other Departments

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20OE301	Fundamentals of Communication Engineering	OE	3	3	0	0	3
2.	20OE302	Microprocessor and Embedded Systems	OE	3	3	0	0	3
3.	20OE303	Fundamentals of Wireless Communication	OE	3	3	0	0	3
4.	20OE304	Satellite Communication Systems	OE	3	3	0	0	3

OPEN ELECTIVE - II (VII SEMESTER) - offered to other Departments

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20OE305	Fundamentals of Image Processing	OE	3	3	0	0	3
2.	20OE306	Consumer Electronics	OE	3	3	0	0	3
3.	20OE307	Fundamentals of Digital Signal Processing	OE	3	3	0	0	3
4.	20OE308	Introduction to VLSI Technology	OE	3	3	0	0	3

HUMANITIES AND SOCIAL SCIENCES (HS)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20HS101	English for Technical Communication	HS	3	3	0	0	3
2.	20HS201	Advanced Technical Communication	HS	3	3	0	0	3
3.	20HS301	Universal Human Values	HS	3	2	1	0	3
4.	20HS401	Environmental Science and Engineering	HS	2	2	0	0	2
Total Credits (HS)								**11**

BASIC SCIENCES (BS)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20BS101	Fundamentals of Engineering Mathematics	BS	4	3	1	0	4
2.	20BS102	Engineering Physics	BS	3	3	0	0	3
3.	20BS103	Engineering Chemistry	BS	3	3	0	0	3
4.	20BS1L1	Basic Science Laboratory	BS	3	0	0	3	1.5
5.	20BS201	Laplace Transform and Advanced Calculus	BS	4	3	1	0	4
6.	20BS203	Physics for Electronics Engineering	BS	3	3	0	0	3
7.	20BS302	Linear Algebra and Partial Differential Equations	BS	4	3	1	0	4
Total Credits (BS)								**22.5**

PROFESSIONAL CORE (PC)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20EC201	Network Analysis	PC	4	3	1	0	4
2.	20EC2L1	Circuits and Devices Laboratory	PC	4	0	0	4	2
3.	20EC301	Analog Circuits	PC	3	3	0	0	3
4.	20EC302	Signals and Systems	PC	4	3	1	0	4
5.	20EC303	Digital System Design	PC	4	3	1	0	4
6.	20EC3L1	Analog Circuits Laboratory	PC	3	0	0	3	1.5
7.	20EC3L2	Digital System Design Laboratory	PC	3	0	0	3	1.5
8.	20EC401	Random Process and Information Theory	PC	3	3	0	0	3
9.	20EC402	Computer Architecture and Organization	PC	3	3	0	0	3
10.	20EC403	Electromagnetic Fields	PC	4	3	1	0	4
11.	20EC404	Analog Electronics and Integrated Circuits	PC	3	3	0	0	3
12.	20EC405	Principles of Digital Signal Processing	PC	5	2	1	2	4
13.	20EC4L1	Analog Integrated Circuits Laboratory	PC	3	0	0	3	1.5
14.	20EC508	Control System Engineering	PC	4	3	1	0	4
15.	20EC509	Transmission Lines and Wave Guides	PC	4	3	1	0	4
16.	20EC510	Analog and Digital Communication Techniques	PC	4	3	1	0	4
17.	20EC511	Microprocessor and Microcontroller Based Systems	PC	3	3	0	0	3
18.	20EC505	Digital VLSI Design and FPGA Implementation	PC	5	3	0	2	4
19.	20EC5L1	Communication Systems Laboratory	PC	3	0	0	3	1.5
20.	20EC5L4	Microprocessor and Microcontroller Based Systems Laboratory	PC	3	0	0	3	1.5
21.	20EC604	Modern Antennas in Wireless Telecommunications	PC	4	3	1	0	4
22.	20EC602	Communication Networks	PC	5	3	0	2	4
23.	20EC705	Microwave and Optical Communications	PC	4	3	1	0	4
24.	20EC702	Wireless Communication	PC	3	3	0	0	3
25.	20EC7L1	Microwave and Optical Communication Laboratory	PC	4	0	0	4	2
							Total Credits (PC)	**77.5**

ENGINEERING SCIENCES (ES)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20GE101	Problem Solving using Python Programming	ES	3	3	0	0	3
2.	20GE1L1	Python Programming Laboratory	ES	4	0	0	4	2
3.	20GE1L2	Industrial Practices Workshop	ES	3	0	0	3	1.5
4.	20GE201	Engineering Graphics	ES	4	2	0	2	3
5.	20GE204	Basic Electrical Engineering and Electron Devices	ES	3	3	0	0	3
6.	20GE2L2	Unix and Shell Scripting Laboratory	ES	3	1	0	2	2
7.	20CS303	Object Oriented Programming and Data Structures	ES	5	3	0	2	4
							Total Credits (ES)	**18.5**

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20HS4L1	Professional Communication and Technical Presentation	EEC	3	0	0	3	1.5
2.	20EC6L1	Mini Project	EEC	4	0	0	4	2
3.	20EC8L1	Project Work	EEC	20	0	0	20	10
							Total Credits (EEC)	**13.5**

MANDATORY COURSES (MC)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20MC501	Constitution of India	MC	1	1	0	0	-

SUMMARY

S.No.	CATEGORY	NUMBER OF CREDITS									
		I SEM	II SEM	III SEM	IV SEM	V SEM	VI SEM	VII SEM	VIII SEM	Total Credits	Credit %
1.	Humanities and Social Sciences / Management Elective (HS)	3	3	3	2	3				14	8.24
2.	Basic Sciences (BS)	11.5	7	4						22.5	13.24
3.	Engineering Sciences (ES)	6.5	8	4						18.5	10.88
4.	Employability Enhancement Courses (EEC)				1.5		2		10	13.5	7.94
5.	Professional Core (PC)		6	14	18.5	22	8	9		77.5	45.59
6.	Professional Elective (PE)						9	9		18	10.59
7.	Open Elective (OE)						3	3		6	3.53
8.	Mandatory Courses (MC)					-				-	
Credits per Semester		21	24	25	22	25	22	21	10	170	
Credits per Year		45		47		47		31		170	
Total Credits		**170**									

20HS101 ENGLISH FOR TECHNICAL COMMUNICATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course is designed for entry level Engineering and Technology curriculum enabling the students to learn, acquire and apply for their learning and career.
- The course is aimed at providing effective skills for promoting communication skills through English.
- Students will benefit in conversing with the peers, faculty and fellow professionals.
- The outcome of this course contains refined level of English proficiency by acquiring all four skills, listening, speaking, reading and writing to prepare them for global readiness.

PRE-REQUISITE: NIL

UNIT-I FOCUSING LANGUAGE DEVELOPMENT 9

Listening: Listening to TV News, Guest Lecturers, Note – taking. **Speaking**: Pronunciation Common Vocabulary – Technical Vocabulary – Answering Peer Questions – Conversation with Teacher. **Reading**: News magazines, Reading for unfamiliar words, Variety of News Items

Writing: Word formation – Auxiliary verbs – Modal Verbs – Sentence Types – Affirmative, Negative, Interrogative, Concord – Dialogue Writing, Letter to Principal / Director – Instructions using Auxiliary

UNIT-II GRAMMAR AND TECHNICAL READING 9

Listening: Listening to Peer Conversations – Brief Speeches – Listening for Specific Information – Recap of Speeches. **Speaking**: Wh Questions, Day today conversations, Telephonic enquiries official/formal enquiries. **Reading**: Technical Essays – Identifying Sentence Types – Classifying the verb patterns. **Writing**: Tenses – Simple Present, Present Progressive, Present Perfect, Present Perfect Continuous – Voice – Active & Passive – Précis Writing – Essay Writing

UNIT - III GRAMMAR AND LANGUAGE DEVELOPMENT 9

Listening: TV interviews, Commentaries, Digital Videos for World Information. **Speaking**: Telephonic Conversation – Classroom Activities – Conversing Information.**Reading**: Coherence, Development of Thoughts. **Writing**: Tenses – Simple Past, Past Progressive, Past Perfect, Past perfect continuous – Impersonal Passive-Narrating the past events, Letter to friend/father about Industrial Visit/Functions held – Narrating the past experience using Impersonal Passive voice

UNIT - IV READING AND LANGUAGE DEVELOPMENT 9

Listening: Listening to Dialects of English – British & American Regional. **Speaking**: Role Plays, Extempore, Responding to specific questions. **Reading**: Comprehensive passages, Reading for specific points. **Writing**: Tenses – Simple Future, Future progressive, Future Perfect, Future Perfect continuous – Definition – Phrases of Reason – Cause & Effect, Recommendations, Argumentative Essays, Letter to the Editor on Social Issues – Analytical Essays on Social hazards using Cause and Effect.

UNIT - V EXTENDED WRITING 9

Listening: Listening to Technical Seminar speeches – Listening to achievers, eminent personalities – Dialects – Australian – African – Asian. **Speaking**: Welcome address, Compeering, Vote of Thanks, Peer debates. **Reading**: Texts on self-confidence, motivation, success path. **Writing**: Contracted forms, Conditionals, Articles, Preposition, Tense – 'going

to' - Error Spotting, Sequence Words – Rearranging – Writing a Book Review – Summary writing – Rearranging Sentences using Sequence Words, Note Making

TOTAL: 45 PERIODS

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : English for Technical Communication		**Course Code :** 20HS101
CO	**Course Outcomes**	**K-CO**
C101.1	Listen, Comprehend and Correspond with others at various contexts	AD
C101.2	Speak legibly and fluently under various life-time situations by applying proper communication modules.	AD
C101.3	Read and understand a variety of writings and technical text by analyzing the meaning and language	AD
C101.4	Apply clear and legible writing skills in error free style in coherent manner	AD
C101.5	Remember and use various communicative skills in precise and efficient way on technological contexts	AD
C101.6	Form situational conversations and technical writing styles for interpersonal and effective communication	AD

TEXT BOOKS:

1. Board of Editors. "Using EnglishA Course book for Undergraduate Engineers and Technologists". Orient Black Swan Limited, Hyderabad: 2015
2. Richards, C. Jack. "Interchange Students' Book-2", New Delhi: CUP, 2015.

REFERENCES:

1. Murphy, Raymond "English Grammar in Use with Answers: Reference and Practice for Intermediate Students", Cambridge: CUP, 2004
2. Thomson, A.J. and Martinet, A.V. "A Practical English Grammar", OUP, New Delhi: 1986
   Anne Laws, "Writing Skills", Orient Black Swan, Hyderabad, 2011
3. Board of Editor, "English for Technical Communication", Great Mind Publication, Chennai : 2018

20BS101 FUNDAMENTALS OF ENGINEERING MATHEMATICS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To relate various methods of Matrix Algebra to handle practical problems arising in the field of engineering.
- The main aim of this course is to achieve conceptual understanding and to retain the best traditions of Calculus.
- The syllabus is designed to provide the basic tools of Calculus of Single and Multivariable, mainly for the purpose of modeling the engineering problems mathematically and obtaining solutions.

PRE-REQUISITE: NIL

UNIT-I MATRICES 12

Introduction to Matrices-Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton Theorem – Diagonalization of matrices – Reduction of a Quadratic form to Canonical form by Orthogonal transformation – Nature of Quadratic forms.

UNIT - II DIFFERENTIAL CALCULUS 12

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Differentiation of Polynomials, Exponential, Trigonometric, Hyperbolic, Logarithmic and Implicit functions- Maxima and Minima of functions of single variable.

UNIT – III FUNCTIONS OF SEVERAL VARIABLES 12

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Maxima and Minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT – IV INTEGRAL CALCULUS 12

Definite and Indefinite integrals - Substitution rule - Techniques of integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions, Improper integrals.

UNIT – V ORDINARY DIFFERENTIAL EQUATIONS 12

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Fundamentals of Engineering Mathematics		**Course Code :** 20BS101
CO	**Course Outcomes**	**K-CO**
C102.1	Determine the Eigen values, Eigen vectors to diagonalize a matrix and reduce quadratic form to canonical form.	K3
C102.2	Apply the concept of limits, continuity, rules of differentiation, and techniques of differentiation to differentiate standard functions.	K3
C102.3	Apply the concepts of Concavity, Convexity to determine the critical points, point of Inflection, Maxima and Minima of Single variable functions.	K3
C102.4	Compute the derivatives of functions of two variables and apply them to calculate the maxima and minima.	K3
C102.5	Determine integrals using techniques of integration, such as substitution, partial fractions and integration by parts.	K3
C102.6	Apply various techniques to solve higher order differential equations with constant and variable Coefficients.	K3

TEXT BOOKS:

1. Grewal B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 44th Edition, 2017.
2. T. Veerarajan., “Engineering Mathematics I”, The Tata Mc Graw Hill Publication-New Delhi, First Edition, 2018

REFERENCES:

1. James Stewart, “Calculus, Early Transcendental”, Cengage Learning, 7th Edition, New Delhi, 2015. [For units II & III].
2. 2. Kreyszig Erwin, “Advanced Engineering Mathematics”, John Wiley and Sons, 9th Edition, New Delhi, 2006.
3. Wiley, “Calculus- International Student version”, 10thEdition, Wiley India Pvt. Ltd, New Delhi 2017.
4. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”, NarosaPublications,New Delhi, 5th Edition , 2016.
5. Bali N., Goyal M. and Watkins C., “Advanced Engineering Mathematics II”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 9thEdition, 2014.

20BS102	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To inculcate the fundamental knowledge in properties of matter and crystal physics.
- To enrich the knowledge on Laser, fiber optics and ultrasonics and their applications relevant to various streams of Engineering andTechnology.
- To introduce quantum physics and its applications.

PRE-REQUISITE: NIL

UNIT - I PROPERTIES OF MATTER **9**

Elasticity – Hooke's Law – Stress-strain diagram and its uses – Three modulus of elasticity (qualitative) – Poisson's ratio – factors affecting elastic modulus and tensile strength – twisting couple – torsional 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 LASER AND FIBER OPTICS **9**

Lasers: Interaction of radiation with atomic energy states – Einstein's A and B coefficients derivation – Population inversion – resonant cavity, optical amplification (qualitative) – solid statelasers – Nd:YAG laser, Semiconductor lasers: homojunction and heterojunction – Fiber optics: principle, numerical aperture and acceptance angle – types of optical fibers (material, refractive index, mode) – losses associated with optical fibers – fiber optic sensors: pressure and displacement sensor.

UNIT - III ULTRASONICS **9**

Ultrasonics – classification (qualitative) – properties – generation – magnetostriction and piezoelectric methods – detection of ultrasound – cavitations – velocity measurement – acoustic grating – Industrial applications (Drilling, Welding, Soldering and Cleaning) – SONAR – NDT – Pulse Echo system through Transmission and Reflection modes – A, B and C scan displays - Medical application – sonogram.

UNIT - IV QUANTUM PHYSICS **9**

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

UNIT - V CRYSTAL PHYSICS **9**

Crystalline and amorphous materials – unit cell, crystal systems, Bravais lattices, lattice planes - Miller indices – Inter planar spacing in cubic lattice – coordination number and packing factor for SC, BCC, FCC, HCP structures – growth of single crystals: solution and melt growth techniques – Mechanisms of plastic deformation, slip and twinning.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Engineering Physics		**Course Code :** 20BS102
CO	**Course Outcomes**	**K-CO**
C103.1	Demonstrate the properties of elasticity and measure the different moduli of elasticity.	K3
C103.2	Discuss the characteristics of laser and optical fiber.	K2
C103.3	Explain the concepts of ultrasonics in engineering.	K2
C103.4	Explain black body radiation, properties of matter waves and Schrodinger equation.	K2
C103.5	Classify the Bravais lattices and different types of crystal structures.	K3
C103.6	Summarize the informations on growth of crystals and deformations.	K2

TEXT BOOKS:

1. R. K. Gaur and S. L. Gupta, “Engineering Physics”, Dhanpat Rai Publications, 2012.
2. B. K. Pandey and S. Chaturvedi, “Engineering Physics”, Cengage Learning India, 2018.
3. V.Rajendran, “Engineering Physics”, Tata McGraw Hill Education Private Limited, 2011.

REFERENCES:

1. D.Halliday, R. Resnick and J. Walker, “Principles of Physics”, Wiley publisher, 10th Edition, 2015.
2. R.A.Serway and J.W. Jewett, “Physics for Scientists and Engineers”, Cengage Learning, 2014.
3. P.A.Tipler and G. Mosca, “Physics for Scientists and Engineers with Modern Physics”, W.H.Freeman, 2007.
4. D.K.Bhattacharya and T. Poonam, “Engineering Physics”, Oxford University Press, 2017.

20BS103	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the students, familiar with boiler feed water requirements, related problems and water treatment techniques.
- To learn the principle of electrochemical cell, types of corrosion and its control.
- To develop an understanding of the basic concepts of phase rule and its applications to one and two component systems and appreciate the purpose and significance of alloys.
- To be familiar with different types of fuel and their characteristics and also functioning of energy storage devices.
- To understand the techniques of spectra and chromatography for analytical purpose.

PRE-REQUISITE: NIL

UNIT - I WATER AND ITS TREATMENT 9

Characteristics of water; Hard water, Soft water, difference; Hardness – types of hardness, expression of hardness, units, removal of hardness (boiling, soda lime process), estimation of hardness of water by EDTA method (problems); Boiler feed water – requirements – disadvantages of using hard water in boilers (scale and sludge, priming and foaming, caustic embrittlement, boiler corrosion); Treatment of boiler feed water – internal treatment (carbonate, phosphate, and calgon conditioning) external treatment – ion exchange process, zeolite process**;** Purification of water- reverseosmosis, electro dialysis, Application of nanomaterials in water purification.

UNIT - II ELECTROCHEMISTRY AND CORROSION 9

Electrochemical cell - redox reaction, electrode potential- origin of electrode potential- oxidation potential- reduction potential, - electrochemical series and its significance - Nernst equation (derivation and problems).

Corrosion- causes- factors, electrochemical corrosion (galvanic, differential aeration), corrosion control - material selection and design aspects - electrochemical protection – sacrificial anode method and impressed current cathodic method **–** corrosion inhibitors. Metallic coating – Electroplating – Factors - Electroplating of Copper and Electroless plating of Nickel.

UNIT - III PHASE RULE AND ALLOYS 9

Phase rule - introduction, definition of terms with examples; One component system - water system; Reduced phase rule - two component system, classification, lead-silver system; Alloys – introduction, definition, properties of alloys, significance of alloying; Functions and effects of alloying elements; Heat treatment of steel - annealing, hardening, tempering, carburizing, nitriding; Ferrous alloys- nichrome and stainless steel (18/8); Non-ferrous alloys – brass and bronze.

UNIT - IV FUELS AND BATTERIES 9

Fuels – classification, characteristics; Petrol – characteristics, knocking, octane number; Diesel – characteristics, cetane number; Natural gas (CNG), LPG, Power alcohol, Biodiesel, Gasohol; Combustion of fuels – calorific value, GCV and NCV (Problems),calculationoftheoretical air for combustion (Problems), Ignition temperature, explosive range, flue gas analysis (Orsatapparatus);

Batteries – primary and secondary batteries, lead-acid battery, lithium ion battery, Fuel cell (hydrogen oxygen fuel cell).

UNIT - V ANALYTICAL TECHNIQUES 9

Spectroscopic techniques – UV-visible(Principle and Instrumentation – Block Diagram only and applications), IR(Principle and Instrumentation – Block Diagram only and applications), ^{1}H NMR ((Principle and Instrumentation – Block Diagram only) – Chromatography – HPLC - Flame photometry – Estimation of sodium by Flame photometry.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Engineering Chemistry		**Course Code :** 20BS103
CO	**Course Outcomes**	**K-CO**
C103.1	Determine the hardness of water and explain the water treatment methods.	K2
C103.2	Apply Nernst equation to determine the EMF of the cell and explain various corrosion control methods.	K3
C103.3	Describe the phase diagram of one component and two component system and various methods of heat treatment of steel.	K2
C103.4	Classify the various types of fuels by their characteristics and explain the flue gas analysis by Orsat method.	K2
C103.5	Illustrate the working of Lead acid battery, lithium ion battery and fuel cell.	K2
C103.6	Describe the instrumentation and working of UV, IR, HNMR, HPLC and flame photometry.	K2

TEXT BOOKS:

1. P.C. Jain and Monika Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company (P) LTD, New Delhi, 2017
2. S.S Dara and S.S Umare, “A Text Book of Engineering Chemistry”, S.Chand& Company Limited, 20th Edition, 2018.

REFERENCES:

1. Shashi Chawla, “A Textbook of Engineering Chemistry”, Dhanpat Rai & CO. (PVT) LTD, New Delhi, 2012.
2. B.R. Puri, L.R. Sharma, M.S. Pathania, Vishal, “Principles of Physical Chemistry”, Vishal Publishing Co., Punjab, 47th Edition, 2017.
3. G Palanna, “Engineering Chemistry”, McGraw Hill Education (India) PVT, LTD, Chennai, 2017.
4. Dr. Sunita Rattan, “A Textbook of Engineering Chemistry”, S.K.Kataria& Sons, New Delhi, 2012.

20GE101	PROBLEM SOLVING USING PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the basics of Computers and algorithmic problem solving
- To understand Python programs with conditional and looping constructs.
- To define Python functions and strings.
- To use Python data structures – lists, tuples, sets and dictionaries.
- To do input/output with files in Python.

PRE-REQUISITE: NIL

UNIT-I COMPUTER FUNDAMENTALS AND PROBLEM SOLVING 9

Introduction to Computer System – Block Diagram of Computer, Types of Memory, I/O Devices, Application Programs, System Programs – Loader, linker, assembler, compiler, interpreter, Programming process – source code to executable code, Problem Solving Strategies – Problem analysis, Algorithms, Flow Charts, Pseudo Code. Illustrative problems: odd or even number, Leap year, Biggest of three numbers, square root of a number, Sum of n numbers, Armstrong number, Palindrome, Fibonacci Series, Prime number, Bubble Sort and Linear Search.

UNIT-II DATA, EXPRESSIONS, CONTROL FLOW STATEMENTS 9

Python interpreter and interactive mode, values and types – int, float, boolean, string, and list, variables, expressions, statements, tuple assignment, operators and precedence of operators, comments, Control Flow Statements – Conditionals – conditional (if), alternative (if-else), chained conditional (if-elif-else), Iteration – state, while, for, break, continue, pass, Illustrative programs – exchange the values with and without using temporary variables, circulate the values of n variables, distance between two points.

UNIT - III FUNCTIONS, STRINGS 9

Functions – function definition and use, flow of execution, parameters and arguments, function composition, Fruitful functions – return values, parameters, local and global scope, recursion, Strings – string slices, immutability, string functions and methods, string module, Illustrative programs – square root, GCD, exponentiation, Factorial of a number, linear search, binary search.

UNIT - IV LISTS, TUPLES, SETS, DICTIONARIES 9

Lists – list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters, Lists as arrays, Tuples – tuple assignment, tuple as return value, Sets - Creating a set, Modifying a set, Removing elements from a set, Set operations- Set Union, Set intersection, Set difference, Set membership test, Iterating through a set, Set methods, Built-in functions with set, Frozenset - Dictionaries – operations and methods, Advanced list processing –List comprehension, Illustrative programs – selection sort, insertion sort, Matrix addition and subtraction, sum an array of numbers.

UNIT - V FILES, MODULES, PACKAGES 9

Files and exception – text files, reading and writing files, format operator, command line arguments, errors and exceptions, handling exceptions, modules, packages – Math and Rand, Illustrative programs – word count, copy file, merge two files.

TOTAL: 45 PERIODS

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Problem Solving using Python Programming		**Course Code :** 20GE101
CO	**Course Outcomes**	**K-CO**
C105.1	Explain Components of a Computer System, types of programming languages, types of software with examples and purpose.	K2
C105.2	Perform problem analysis, use algorithms and prepare flow charts, pseudo code for solving simple problems.	K3
C105.3	Use Conditional, iteration constructs of python programming and apply to solve simple problems.	K3
C105.4	Use Functions, recursive function, String functions in python programming and apply to perform linear and binary search.	K3
C105.5	Explain the various operations for manipulating Tuples, Sets, Dictionaries and Use List to perform simple and sorting operations.	K2
C105.6	Explain file handling operations, exception handling, modules and packages and illustrate programs for word count, file copy, merge operations and exception handling.	K2

TEXT BOOKS:

1. E. Balagurusamy, “Problem solving and Python Programming”, First edition, McGraw Hill Education (India) Private Limited, 2017.
2. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)

REFERENCES:

1. YashavantKanetkar, Aditya Kanetkar, “Let Us Python”, 2nd Edition, BPB Publications, 2020.
2. John V Guttag, “Introduction to Computation and Programming Using Python: With Application to Understanding Data”, 2nd Edition, PHI Publisher,2017.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd.,2015.
5. Paul Gries, Jennifer Campbell and Jason Montojo, “Practical Programming: An Introduction to Computer Science using Python 3.6”, 3rdedition, Shroff/O’ Reilly Publishers,2018.
6. Dr.A.Kannan,Dr.L.SaiRamesh,“ProblemSolvingandPythonProgramming”,UpdatedEdition, United Global Publishers Pvt. Ltd., April 2018.

20BS1L1 **BASIC SCIENCE LABORATORY**

L	T	P	C
0	0	3	1.5

PHYSICS LABORATORY

OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in Optics, properties of matter and liquids.

PRE-REQUISITE: NIL

LIST OF EXPERIMENTS
(Any five to be carried out & one demonstration experiment)

1. Determination of Rigidity modulus – Torsional Pendulum.
2. Determination of Young's modulus – Non Uniform Bending.
3. a. Determination of wavelength and particle size using diode laser.
   b. Determination of acceptance angle in an optical fiber.
4. Determination of velocity of sound and compressibility of liquid using ultrasonic interferometer.
5. Determination of band gap of a semiconductor diode.
6. Determination of thickness of a thin wire – Air wedge method.
7. Determination of dispersive power of a prism – Spectrometer*
8. Determination of wavelength of mercury spectrum – Spectrometer grating
   *Demonstration experiment.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Torsional pendulum set	6
2	Travelling microscope & accessories	6
3	Laser kit	6
4	Ultrasonic interferometer	6
5	Semiconductor band gap kit	6
6	Air wedge set up	6
7	Spectrometer & prism	6
8	Spectrometer & Grating	6

CHEMISTRY LABORATORY

OBJECTIVES:

- To make the students to acquire practical skill in the determination of water quality parameters through volumetricanalysis.
- To have hands on experience in using instruments like pH meter, conductivitymeter,potentiometer.
- To acquaint the students with the determination of molecular weight of polymer by viscometer.

PRE-REQUISITE: NIL

Any Five experiments to be given

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
3. Determination of dissolved oxygen content of water sample by Winkler's method.
4. Determination of strength of given hydrochloric acid using pH meter.
5. Estimation of iron content of the given solution using potentiometer.
6. Conductometric titration of a strong acid Vs a strong base.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
9. Corrosion Experiment – Weight Loss Method.
10. Estimation of sodium present in water using flame photometer.

TOTAL(Physics & Chemistry): 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Basic Science Laboratory		**Course Code :** 20BS1L1
CO	**Course Outcomes**	**K-CO**
C106.1	Calculate rigidity modulus and Young's modulus of a given material.	K3
C106.2	Examine the size of a given particle, parameters of optical fiber and compute the thickness of a given thin wire.	K3
C106.3	Calculate the velocity of ultrasound, compressibility of a given liquid and band gap of a given semiconductor diode.	K3
C106.4	Predict dispersive power of prism and wavelength of mercury spectrum.	K2
C106.5	Estimate the Chemical quality parameter of a water sample.	K3
C106.6	Estimate the strength of acid by conduct metric and pH metric titration.	K3
C106.7	Estimate the amount of iron content in a given solution using potentiometer and the amount of sodium in water using flame photometer.	K3
C106.8	Determine the molecular weight of polyvinyl alcohol using Ostwald viscometer and rate of corrosion by weight loss method. (Demo)	K2

REFERENCE:

1. Vogel's "Text book of quantitative chemical analysis" (8th edition, 2014)

LIST OF APPARATUS AND EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Burette	30
2	Pipette	30
3	Beaker (100ml)	30
4	Conical Flask (250ml)	30
5	Conductivity meter	10
6	Potentiometer	10
7	pH meter	10
8	Viscometer	10
9	Flame Photometer	1
10	Electronic Balance	1

20GE1L1 PYTHON PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To write, test, and debug simple Python programs using conditional statements.
- To implement Python programs using loops.
- To use functions for structuring Python programs.
- To implement Python programs using lists.
- To write Python programs for implementing file operations.

PRE-REQUISITE: NIL

LIST OF PROGRAMS

1. Biggest of three numbers, odd or even number, Leap year.
2. GCD, Armstrong Number, Palindrome, Fibonacci Series, Prime number
3. Find the square root and exponentiation of a number with and without built-in functions
4. Linear search and Binary search using Recursion.
5. Find the maximum of a list of numbers
6. Selection sort, Insertion sort
7. First n prime numbers
8. Transpose of a Matrix
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Merge two files

PLATFORM NEEDED: Python 3 interpreter for Windows/Linux

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Python Programming Laboratory		**Course Code :** 20GE1L1
CO	**Course Outcomes**	**K-CO**
C107.1	Develop simple Python programs using conditional and iterative constructs.	K3
C107.2	Develop simple Python programs using built-in functions and user-defined functions.	K3
C107.3	Develop a Python program using recursion to implement linear and binary search.	K3
C107.4	Develop a Python program using list to implement selection and insertion sort	K3
C107.5	Develop Python programs to implement matrix operations	K3
C107.6	Develop a Python program to implement file handling.	K3

20GE1L2	INDUSTRIAL PRACTICES WORKSHOP	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To provide exposure to the students with Hands on Experience on various Basic Industrial Practices in Civil, Mechanical, Electrical and Electronics Engineering.

PRE-REQUISITE: NIL

GROUP A (CIVIL & MECHANICAL)
LIST OF EXPERIMENTS

I CIVIL ENGINEERING PRACTICE

UNIT-I CARPENTRY PRACTICE

1. Study of carpentry tools.
2. Preparation of Cross lap joint
3. Preparation of Dovetail joint
4. Preparation of T joint

UNIT-II PLUMBING PRACTICE

1. Study of plumbing tools, pipeline joints, its location and functions: valves, taps, couplings, unions, reducers and elbows in household fittings.
2. Exercise on Preparation of plumbing line sketches for water supply and sewage works.
3. Exercise on providing of basic water line connection for a residential house using plumbing components.
4. Exercise on providing Water line pipe connections for household utilities like water heater, wash basin etc.,

II MECHANICAL ENGINEERING PRACTICE

UNIT - III SHEET METAL PRACTICE

1. Study of sheet metal forming tools.
2. Preparation of a Model of rectangular tray.
3. Preparation of a Model of Conical Funnel.

UNIT - IV MACHINING PRACTICE

1. Study of machining tools.
2. Exercise on Simple turning, Facing, Chamfering
3. Exercise on Taper turning.
4. Exercise on Drilling and Tapping.

UNIT – V METAL JOINING PROCESS

1. Study of welding tools.
2. Exercise to join two metal plates by single butt joint using arc welding.
3. Exercise to join two metal plates by T Fillet joint using arc welding.
4. Exercise to join two metal plates by lap joint using arc welding.

DEMONSTRATION

1. Gas welding process.
2. Refrigeration and Air conditioning process.

GROUP B (ELECTRICAL & ELECTRONICS)
LIST OF EXPERIMENTS

I ELECTRICAL ENGINEERINGPRACTICE

1. Residential house wiring using switches, fuse, indicator, Fluorescent lamp and Energy Meter.
2. Measurement of Power consumption for CFL, Fluorescent Lamp, LEDLamp and Incandescent lamp.
3. Stair case wiring
4. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit.
5. Measurement of energy using single phase energy meter.
6. Measurement of resistance to earth of an electrical equipment.

II ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components – Resistor colour coding, Capacitor, Inductor-Measurement using LCR meter, Transistor &Diode – Terminal identification using Multimeter.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Measurement of AC signal parameter (peak-peak, rms value, period & frequency) using CRO and AFO.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS		
CIVIL		
S. No	**Component Name**	**No. of Components**
1	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, coupling, unions, elbows, plugs and other fittings	15 sets
2	Carpentry Vice (fitted to work bench)	15 nos
3	Standard wood working tools	15 sets
4	Models of industrial trusses, door joints, furniture joints	5 each
5	Power Tools a. Rotary Hammer b. Demolition Hammer c. Circular Saw d. Planer e. Hand Drilling Machine	 2 nos 2 nos 2 nos 2 nos 2 nos

	f. Jigsaw	2 nos
MECHANICAL		
1	Arc welding transformer with cables and holders	5 nos
2	Welding booth with exhaust facility	5 nos
3	Welding accessories like welding shield, chipping hammer, wire brush, etc.	5 sets
4	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 nos
5	Centre Lathe	2 nos
6	Power Tool: Angle Grinder	2 nos
7	Study purpose items: Refrigerator and Air Conditioner	One each
ELECTRICAL		
1	Assorted electrical components for house wiring	10 sets
2	Electrical measuring instruments	10 sets
3	Study purpose items: Iron box, fan and regulator, emergency lamp	1 each
4	Megger (250V/500V)	1 no.
5	Power Tools a. Range Finder b. Digital Live-wire detector	 2 nos 2 nos
ELECTRONICS		
1	Soldering guns	10 nos
2	Assorted electronic components for making circuits	50 nos
3	Small PCBs	10 nos
4	Multimeters	10 nos
5	Regulated of power supply, CRO	1 no. each

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Industrial Practices Workshop		**Course Code :** 20GE1L2
CO	**Course Outcomes**	**K-CO**
C108.1	Prepare different carpentry joints and pipe connections with different joints.	K3
C108.2	Make the models using sheet metal.	K3
C108.3	Carry out the basic machining operations.	K3
C108.4	Prepare arc welded joints using welding equipment.	K3
C108.5	Demonstrate wiring for a simple residential house; identify the ratings of tube lamp, and calculate the different Electrical quantities.	K3
C108.6	Measure the electronics equipment using LCR meter, Transistor & Diode – Terminal identification using Multimeter.	K3
C108.7	Experimentally to analyze AC signal parameters using CRO and AFO and to verify the Truth tables of Logic gates.	K3
C108.8	Experimentally to design a Simple circuit using soldering in a PCB, measure ripple factor of Half Wave Rectifier and Full Wave Rectifier.	K3

20HS201 ADVANCED TECHNICAL COMMUNICATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course is designed for Engineering and Technology curriculum enabling the students to learn, acquire and apply updated elements of English communication.
- The course is aimed at providing effective skills for procuring communication skills for business and advanced technology.
- Students will benefit by learning the four skills – Listening, Speaking, Reading and Writing – to meet the global requirements for their career and higher studies.

PRE-REQUISITE: NIL

UNIT-I TECHNICAL WRITING 9

Listening: Listening to audio-visuals on personal Interviews, Speeches from Company CEOs, TV Debates. **Speaking**: Wishing, Greeting, Enquiring Hobbies. **Reading**: Editorials, Letter to the Editor Columns, Technical Papers. **Writing**: Analytical writings, Emphasis Techniques, Letter Writing – Business Correspondence, Abstract Writing, Common Errors, Footnotes, Compound words, Preparation of Agenda

UNIT-II BUSINESS ENGLISH AND LANGUAGE DEVELOPMENT 9

Listening: Listening to Audio-Visual documentary, TV Programs of Celebrities Forum. **Speaking**: Self-Expression, Introducing the fellow students, Talking about celebrities, leaders

Reading: Company Correspondence, Business Correspondence, Technical Text for Vocabulary

Writing: Bibliography, Sentence Completion, Cloze exercises, Verbal Analogy, Letter – Business enquiry orders, payments, Minutes Preparation.

UNIT - III VISUAL BASED LANGUAGE DEVELOPMENT 9

Listening: Visuals on Group Discussion-Understanding the nuances of GD – Approach – Content – Methodology. **Speaking**: Discussing main points on burning issues, Social issues – Expressing ideas and suggestions. **Reading**: Etiquettes of Non-Verbal Communication. **Writing**: List of common expressions for specified situations – Sentence linkers – Formal Expressions – Suggestions – Reported Speech - Letter to the Editor on Common Issues – Writing the Points in Indirect Form – Check Lists – Numerical Expression

UNIT - IV EMPLOYABILITY CORRESPONDENCE 9

Listening: Listening to Visuals of Technical Paper presentation – Technical and HR interviews

Speaking: Peer-to-Peer Interview – Mock Interview – Telephone Conversations. **Reading**: Comparative Analyses – Instructions on Public Spots – Time Management concepts – Email Correspondence. **Writing**: Compare and Contrast – Cause and Effect – Purpose and Function – Job Application Letter – Drafting Resume / CV,– Inferring the graphical / Pictorial representations – Bar chart – Pie chart, Instruction – common and technical instructions for a process or a component.

UNIT - V TECHNICAL REPORT WRITING 9

Listening: Key note speeches – Annual Reports of institutions / companies. **Speaking**: Answering to the Mock Panel Interview – Sharing of interview experiences – presenting a Technical Paper. **Reading**: Annual Reports – Company Reports – Newspaper reports – Comprehension passages. **Writing**: Homophones – Abbreviations and Acronyms – SI Units – Report Writing with recommendations – Inferring the Graph – Flow Chart – Tables – Technical Papers

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Advanced Technical Communication		**Course Code :** 20HS201
CO	**Course Outcomes**	**K-CO**
C109.1	Listen, Understand and create technical correspondence at advanced level.	K3
C109.2	Respond or answer to the contextual questions, interview questions, form instructions, draft reports.	K3
C109.3	Speak and analyze social issues, come out with effective ideas for discussion, understand the passages for meaning and vocabulary.	K3
C109.4	Assess error free technical writings, create legible and coherent technical papers, derive ideas of the given texts in a precise form.	K3
C109.5	Remember the updated elements of communication skills, nuances of non-verbal communication, business communication.	K3
C109.6	Create technical instructions, process instructions, self-appraisals, Resumes, reports on various situations.	K3

TEXT BOOKS:

1. Board of editors. “Fluency in English A Course book for Engineering and Technology”. Orient Blackswan, Hyderabad: 2016
2. Raman, Meenakshi and Sharma, “Sangeetha- Technical Communication Principles and Practice”.Oxford University Press: New Delhi,2014.

REFERENCES:

1. Booth-L. Diana, “Project Work”, Oxford University Press, Oxford: 2014
2. Grussendorf, Marion, “English for Presentations”, Oxford University Press, Oxford: 2007
3. Means, L. Thomas and Elaine Langlois, “English & Communication For Colleges. Cengage Learning”, USA: 2007
4. Board of Editor, “Advanced Technical Communication”, Great Mind Publication, Chennai : 2019

20BS201	LAPLACE TRANSFORM AND ADVANCED CALCULUS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To make the student familiar with topics such as Multiple Integrals, Vector Calculus, Analytic Functions,Complex Integration and Laplace Transform.
- To learn the concept of basic Vector Calculus which can be widely used for Modeling the various laws of Physics.
- To understand the various methods of Complex Analysis and Laplace Transform can be used for efficiently solving the problems that occur in various branches of Engineering disciplines.

PRE-REQUISITE: NIL

UNIT - I LAPLACE TRANSFORM **12**

Existence Conditions – Transforms of Elementary Functions – Transform of Unit Step Function and Unit Impulse Function – Basic Properties – Shifting Theorems -Transforms of Derivatives and Integrals – Initial and Final Value Theorems – Inverse Transforms – Convolution Theorem – Transform of Periodic Functions – Application to Solution of Linear Second Order Ordinary Differential Equations with Constant Coefficients.

UNIT-II MULTIPLE INTEGRALS **12**

Double integrals – Change of order of integration – Double integrals in Polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of Solids – Change of Variables in Double and Triple integrals.

UNIT-III VECTOR CALCULUS **12**

Gradient and Directional Derivative – Divergence and Curl - Vector Identities – Irrotational and Solenoidal Vector fields – Line Integral over a Plane curve – Surface Integral - Area of a Curved Surface - Volume Integral – Green's, Gauss divergence and Stoke's theorems – Verification and Application in evaluating Line, Surface and Volume Integrals.

UNIT - IV ANALYTIC FUNCTIONS **12**

Analytic functions – Necessary and Sufficient Conditions for Analyticity in Cartesian and Polar Coordinates – Properties – Harmonic Conjugates – Construction of Analytic Function – Conformal Mapping – Mapping by Functions w = z+c, cz, 1/z , z2 -Bilinear transformation.

UNIT - V COMPLEX INTEGRATION **12**

Line integral – Cauchy's Integral Theorem – Cauchy's Integral Formula – Taylor's and Laurent's Series – Singularities – Residues – Residue Theorem – Application of Residue Theorem for Evaluation of Real Integrals – Use of Circular Contour.

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Laplace Transform and Advanced Calculus		**Course Code :** 20BS201
CO	**Course Outcomes**	**K-CO**
C110.1	Determine the Laplace transform of standard functions using properties.	K3
C110.2	Apply Laplace transform and inverse transform to solve the initial value problems.	K3
C110.3	Solve the multiple integrals and apply the concept to find areas, volumes.	K3
C110.4	Determine the line, surface and volume integrals using Green's, Gauss and Stokes theorems.	K3
C110.5	Determine Analytic functions, Bilinear Transformations and apply the concept of conformal mapping to find the images of given curves.	K3
C110.6	Determine the Contour Integrals using Cauchy's Integral and Residue theorems.	K3

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2017.
2. T. Veerarajan., "Engineering Mathematics I", The Tata Mc Graw Hill Publication-New Delhi, FirstEdition2018.

REFERENCES:

1.Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 9th Edition, NewDelhi, 2006.
2. James Stewart, "Calculus, Early Transcendental", Cengage Learning, 7th Edition, New Delhi, 2015.
3.Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics II", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 9th Edition, 2014.
4.Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics II", Narosa Publications, New Delhi, 5th Edition, 2016.
5.Sastry, S.S. "Engineering Mathematics", Vol.I& II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi, 2014.

20BS203 PHYSICS FOR ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the essential physics of semiconductor device and electron transport properties.
- To inculcate proficiency in dielectric and optical properties of materials.
- To develop the knowledge on nano electronic devices.

PRE-REQUISITE: NIL

UNIT - I ELECTRICAL PROPERTIES OF MATERIALS 9

Classical free electron theory: Derivation of electrical conductivity and Thermal conductivity – Wiedemann-Franz law – Success and failures – Quantum free electron theory: Fermi–Dirac statistics – Density of energy states – Electron in periodic potential (Zone theory): Bloch theorem – Energy bands in solids – metals and insulators – tight binding approximation – Electron effective mass – concept of hole.

UNIT - II SEMICONDUCTOR PHYSICS 9

Properties of semiconductors **–** Energy band diagram – Direct and indirect semiconductors – Intrinsic Semiconductors – Carrier concentration (Derivation) – Variation of Fermi level with temperature **–** Extrinsic semiconductors **–** Carrier concentration in N-type & P-type semiconductors (qualitative) – Variation of Fermi level with temperature and carrier concentration **–** Carrier transport: drift and diffusion transport – Einstein's relation – Hall effect and devices – Zener and avalanche breakdown in p-n junctions – Ohmic contacts – tunnel diode – Schottky diode – MOS capacitor.

UNIT - III DIELECTRIC MATERIALS 9

Basic definitions – polarization processes – Frequency and temperature dependence of polarization – Internal field – Classius-mosotti relation (derivation) – Dielectric constant experiment **–** Relation between dielectric constant and Refractive index – dielectric loss – dielectric breakdown – High K dielectric – applications of dielectric (capacitor, transformer) – Ferro electricity and its applications.

UNIT - IV OPTICAL PROPERTIES OF MATERIALS 9

Classification of optical materials – carrier generation and recombination processes – absorption, emission and scattering of light in metals, insulators and semiconductors (concepts only) - photocurrent in a p-n diode – Photo voltaic effect **–** solar cell and its types – LCD **–** LED – Organic LED – Laser diodes – Exciton – quantum confined stark effect.

UNIT - V NANO ELECTRONIC DEVICES 9

Quantum structures, Quantum confinement – Density of states in quantum well, quantum wire and quantum dot structures(qualitative) **–** Band gap of nanomaterials – Quantum size effect **–** Size dependence of fermi energy – Quantum dot laser **–** Coulomb blockade effect – single electron transistor (SET) **–** Magnetic semiconductor **–** Carbon nanotubes**:** types, properties and applications.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Physics for Electronics Engineering		**Course Code :** 20BS203
CO	**Course Outcomes**	**K-CO**
C111.1	Distinguish classical, quantum electron theories and energy band theory.	K2
C111.2	Discuss the properties of semiconductors with applications of the p-n Junction and diodes.	K2
C111.3	Explain dielectric properties of materials.	K2
C111.4	Apply the concept of optical materials for Opto – electronic applications.	K3
C111.5	Summarize the basic operations of p-n junction devices like solar cells, LED, LCD, etc.	K2
C111.6	Explain different quantum structures, size effect and carbon nanotubes.	K2

TEXT BOOKS:

- B.K.Pandey and S.Chaturvedi, “Engineering Physics”, Cengage learning, 2013.
- V.Rajendran, “Engineering Physics”, Tata Mc Graw-Hill Education, 2011
- Charles Kittel, “Introduction to solid state Physics”, John Wiley & sons, 8th edition, 2015.

REFERENCES:

1. G.W. Hanson, “Fundamentals of nano electronics”, Pearson Education, 2009
2. B. Rogers, Adams and S. Pennathur, “Nanotechnology: Understanding Small Systems”, CRC Press, 2019
3. N. Garcia and A. Damask, “Physics for Computer Science Students”, Springer Verlag, 2012.

20EC201	NETWORK ANALYSIS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To study the basic laws on Circuits and to calculate the voltage and current in circuit using basic theorems.
- To apply the concept of transients and resonance in series and parallel circuit
- To explore two port networks and analyze different types of two port network.

PRE-REQUISITE: NIL

UNIT-I BASIC NETWORK ANALYSIS AND NETWORK TOPOLOGY 12

Basic Circuit Analysis: Ohm‘s Law – Kirchhoff‘s laws – Mesh current and node voltage method of analysis for D.C and A.C. circuits , voltage and current division, source transformation – star delta conversion. **Network topology**: Network topology matrices associated with graphs; incidence, fundamental cut set and fundamental circuit matrices.

UNIT- II NETWORK THEOREMS FOR DC AND AC CIRCUITS 12

Network Theorems: Superposition theorem, Thevenin‘s theorem, Norton‘s theorem, Reciprocity theorem, Maximum power transfer theorem, Duality and dual networks.

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. **Coupled Circuits**: 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 FOR DC AND AC CIRCUITS 12

Transient Analysis: 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 PARAMETER 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

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Network Analysis		**Course Code :** 20EC201
CO	**Course Outcomes**	**K-CO**
C112.1	Apply Kirchoff's law for AC & DC circuits.	K3
C112.2	Apply basic laws in Network topology.	K3
C112.3	Apply network theorems to evaluate AC & DC circuits.	K3
C112.4	Explain the concepts of resonance & coupled circuit.	K2
C112.5	Analyze the transient response for AC & DC circuits.	K4
C112.6	Apply the properties of Two port networks in an electrical circuit	K3

TEXT BOOKS:

1. A Sudhakar, S Shyammohan and Palli, "Circuits and Network Analysis and synthesis Tata McGraw-Hill", 2015.
2. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis‖, McGraw Hill Science Engineering", Eighth Edition, 11th Reprint 2016.

REFERENCES:

1. Joseph Edminister and Mahmood Nahvi, "Electric Circuits, Schaum's Outline Series, Tata McGraw Hill Publishing Company", New Delhi, Fifth Edition Reprint 2016.
2. L Robert Boylested, "Experiments in Circuit Analysis to Accompany Introductory Circuit Analysis", PHI, 2002.
3. M.Russell, Mersereau and Joel R. Jackson, "Circuit Analysis- A System Approach", Pearson Education, 2009.
4. Steven T. Karris, "Circuit Analysis I with MATLAB Applications", Orchard Publications, 2004.

20GE201	ENGINEERING GRAPHICS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To develop graphic skills for communication of concepts, ideas and design of Engineering products.
- To expose national standards related to technical drawings.

PRE-REQUISITE: NIL

CONCEPTS AND CONVENTIONS (Not for Examination)

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 PROJECTION OF POINTS AND LINES 6+6

Orthographic projection – Principles - Principal planes - Projection of points in all quadrants - 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-II PROJECTION OF PLANE SURFACES 6+6

Projection of planes (Polygonal and Circular surfaces) inclined to both the principal planes by rotating object method.

UNIT - III PROJECTION OF SOLIDS 6+6

Projection of simple solids like prisms, pyramids, cylinder and cone 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 6+6

Sectioning of simple solids in vertical position when the cutting plane is inclined to 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, cylinder and cone.

UNIT - V ISOMETRIC PROJECTION AND FREEHAND SKETCHING 6+6

Principles of Isometric Projection – Isometric scale – Isometric projections of simple solids - truncated Prisms and Pyramids.

Visualization concepts and Free Hand sketching : Principles – Representation of Three Dimensional objects – Layout of views - Freehand sketching of multiple views from pictorial views of objects

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Engineering Graphics		**Course Code :** 20GE201
CO	**Course Outcomes**	**K-CO**
C113.1	Familiarize with the fundamentals and standards of engineering graphics.	K2
C113.2	Draw the orthographic projections of points and lines.	K3
C113.3	Draw the orthographic projections of plane surfaces.	K3
C113.4	Draw the projections of simple solids like prisms, pyramids, cylinder and cone.	K3
C113.5	Draw the projections of sectional views of solids and develop its lateral surfaces.	K3
C113.6	Draw the isometric projection and free hand sketching of simple objects.	K3

TEXT BOOKS:

1. Natarajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 30th Edition, 2017.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 15th Edition, 2018.

REFERENCES:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education, 3rd Edition, 2012.

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001: Technical drawings - General principles of presentation.
4. IS 11669 – 1986:General principles of dimensioning on technical drawings.
5. SP 46 *(*2003*)*: Engineering Drawing Practice for Colleges.
6. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

SPECIAL POINTS APPLICABLE TO EXAMINATIONS ON ENGINEERING GRAPHICS:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

20GE204	BASIC ELECTRICAL ENGINEERING AND ELECTRON DEVICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the operation of Electrical Machines
- To learn the working principle and circuit model of Static Devices
- To study about the concepts of semiconductor devices such as PN diode, Bipolar and Field effect transistor and some special semiconductor devices.

PRE-REQUISITE: NIL

UNIT-I DC MACHINES 9

Introduction –Constructional features-Motoring and Generation principle-EMF and Torque equation-Circuit model-Methods of Excitation and Magnetization characteristics-starting and speed control.

UNIT- II AC MACHINES 9

Principle of operation of three-phase induction motors- Construction-Types –Equivalent circuit-single phase induction motors-Construction –types –starting and speed control methods-Alternator-working principle-equation of induced EMF-voltage regulation, synchronous motors-working principle-starting methods-Torque equation-stepper motors.

UNIT-III TRANSFORMER 9

Introduction-Ideal transformer-Accounting for finite Permeability and core loss-circuit model of transformer-Determination of parameter of circuit model of transformer-Voltage Regulation- efficiency-Three Phase transformers-Auto transformers.

UNIT- IV SEMICONDUCTOR DIODE AND SPECIAL DEVICES 9

PN junction diode, Current equations, Switching Characteristics, Breakdown in PN Junction Diodes-Varactor diode – Metal-Semiconductor Junction- MESFET-UJT, SCR, Diac, Triac.

UNIT-V TRANSISTORS 9

NPN -PNP – Operations-Early effect -Current equations – Input and Output characteristics of CE, CB, CC - h-parameter model- JFETs – Drain and Transfer characteristics-Current equations-Pinch off voltage and its significance – MOSFET – Characteristics- Threshold voltage -Channel length modulation, D-MOSFET - E-MOSFET- Characteristics – Comparison of MOSFET with JFET.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Basic Electrical Engineering and Electron Devices		**Course Code :** 20GE204
CO	**Course Outcomes**	**K-CO**
C114.1	Illustrate the principle of operation, starting and speed control of D.C machines.	K3
C114.2	Illustrate the construction, principle of operation and performance of A.C machines.	K3
C114.3	Illustrate the operation and circuit model of transformer	K3
C114.4	Illustrate the theory, construction and operation of semiconductor diode and special Electronic Devices.	K3
C114.5	Demonstrate the concepts and working of Bipolar Junction Transistors	K3
C114.6	Demonstrate the concepts and working of Field effect Transistors such as JFET and MOSFET.	K3

TEXT BOOKS:

1. D P Kothari and I.J Nagarath, “Basic Electrical and Electronics Engineering”, McGraw Hill Education(India) Private Limited, 4th Edition, 2019.
2. S Salivahanan, N Suresh Kumar, “Electronic Devices and Circuits”, McGraw Hill Education(India) Private Limited, 4th Edition, 2012.

REFERENCES:

1. S.K.Bhattacharya “Basic Electrical and Electronics Engineering”, Pearson India,2011.
2. Mittle N., “Basic Electrical and Electronics Engineering”, Tata McGraw Hill,24th Reprint, 2016.
3. Donald A Neamen and Dhrubes Biswas “Semiconductor Physics and Devices”, McGraw Hill Education(India) Private Limited, 4th Edition, 2012.
4. Robert Boylestad and Louis Nashelsky., “Electron Device and Circuit Theory” Pearson Prentice Hall, 10th edition, 2008.

20EC2L1 CIRCUITS AND DEVICES LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To gain hands on experience in KVL & KCL & Various Theorems.
- To learn the characteristics of basic electronic devices such as Diode, BJT,FET, SCR.
- To understand the working of RL, RC and RLC circuits.

PRE-REQUISITE: NIL

LIST OF EXPERIMENTS:

1. Verification of KVL & KCL
2. Verification of Super Position Theorem
3. Verification of Thevenin & Norton theorem
4. Verification of maximum power transfer & reciprocity theorem
5. Determination of Resonance Frequency of Series & Parallel RLC Circuits
6. Transient analysis of RL and RC circuits
7. Characteristics of PN Junction Diode and Zener diode
8. Common Emitter input-output Characteristics
9. Common Base input-output Characteristics
10. FET and UJT Characteristics
11. SCR Characteristics
12. Clipper, Clamper and Full Wave Rectifier circuits

LABORATORY REQUIREMENTS

1. BC 107, BC 148,2N2646,BFW10 – 25 each
2. 1N4007, Inductors – sufficientquantités
3. Bread Boards – 15 Nos
4. CRO (30MHz) – 10 Nos.
5. Function Generators (3MHz) – 10 Nos.
6. Dual Regulated Power Supplies (0 – 30V) – 10 Nos.

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Circuits and Devices Laboratory		**Course Code :** 20EC2L1
CO	**Course Outcomes**	**K-CO**
C116.1	Experimentally verify KVL & KCL in an electrical circuits.	K3
C116.2	Experimentally verify various theorems.	K3
C116.3	Determine the resonant frequency, quality factor & bandwidth of the RLC circuits.	K5
C116.4	Perform the transient analysis of RL & RC circuits	K3
C116.5	Analyze the V-I characteristics of PN diode and its use in rectifier circuits.	K4
C116.6	Analyze the V-I characteristics of FET and SCR.	K4

20GE2L2	UNIX AND SHELL SCRIPTING LABORATORY	L	T	P	C
		1	0	2	2

OBJECTIVES:

- To understand the key features of UNIX
- To familiar with various UNIX commands.
- To understand the concepts of Shell programming.
- To familiarize with 'vi' editor.
- To acquire basic 'C 'programming skills.

PRE-REQUISITE: NIL

LIST OF PROGRAMS

1. Study of UNIX OS, UNIX Architecture, Features of UNIX, Types of Shells.
2. General purpose utilities commands - cal, date, echo, printf, bc, tty, uname
3. Directory related commands – pwd, cd, mkdir, rmdir
4. Files related commands – cat, cp, rm, mv, more, file, wc, cmp, ls, chmod
5. Filtering commands – head, tail, sort, cut, paste, uniq, tr, grep
6. Shell programming – read and echo, conditional statements – if –then-fi, it-then-else-fi, test, nested if-elses, case structure.
7. Shell Programming – Loop Control Structure – while, until, for, break, continue
8. Simple C Programs in 'vi' editor.
9. C Programs using Conditional Statements – Finding Odd or Even, Biggest among three numbers, Finding the number is prime or not,
10. C Programs using Conditional Statements – Reverse the number, Arithmetic operationsusing switch - case.
11. C Programs using Looping Statements – Factorial of n numbers, Checking Armstrong Number or Not.
12. C Programs using Looping Statements – Fibonacci Series, Printing number of uppercase and lowercase letter.
13. C Programs using Command Line Arguments – Biggest Among three numbers
14. C Programs using Arrays – Finding the largest & smallest number in the given array, Sorting Arrays.
15. C Programs using Arrays – Addition and Subtraction of two matrices.

PLATFORM NEEDED: Unix Operating System / any flavor of Linux and C Compiler

TOTAL: 15 + 30 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Unix and Shell Scripting Laboratory		**Course Code :** 20GE2L2
CO	**Course Outcomes**	**K-CO**
C115.1	Demonstrate the various General purpose utilities, Directory, Files and Filtering commands.	K3
C115.2	Develop simple shell programs using conditional and looping constructs.	K3
C115.3	Develop simple C programs in 'vi' editor using conditional and looping statements.	K3
C115.4	Develop simple C programs in 'vi' editor using command line arguments.	K3
C115.5	Develop C programs in 'vi' editor for sorting a given set of numbers.	K3
C115.6	Develop C programs in 'vi' editor to perform matrix addition, subtraction	K3

20BS302	LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To introduce the basic concepts of vector space, linear transformations and diagonalization.
- To apply the concept of inner product spaces in orthogonalization.
- To understand the procedure to solve partial differential equations and to learn application of partial differential equation.

PRE-REQUISITE:
Course Code: 20BS101
Course Name: Fundamentals of Engineering Mathematics

UNIT - I VECTOR SPACES 12

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT - II LINEAR TRANSFORMATIONANDDIAGONALIZATION 12

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations – Eigen values and eigenvectors - Diagonalizability.

UNIT - III INNER PRODUCTSPACES 12

Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

UNIT - IV PARTIAL DIFFERENTIALEQUATIONS 12

Formation – Solutions of first order equations – Standard types and equations reducible to standard types – Singular solutions – Lagrange's linear equation – Integral surface passing through a given curve – Classification of partial differential equations - Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differentialequations.

UNIT - V FOURIER SERIES SOLUTIONS OF PARTIALDIFFERENTIALEQUATIONS 12

Dirichlet's conditions – General Fourier series – Half range sine and cosine series - Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Linear Algebra and Partial Differential Equations		**Course Code :** 20BS302
CO	**Course Outcomes**	**K-CO**
C201.1	Apply the concepts of Vector space to determine bases and dimensions.	K3
C201.2	Determine Eigen values and Eigen vectors using Linear transformations.	K3
C201.3	Construct the least square fit and orthonormal basis for an inner product space by using Gram-Schmidt process.	K3
C201.4	Solve the given first order and higher order partial differential equations with constant coefficients.	K3
C201.5	Derive the full range and half range series of the given function.	K3
C201.6	Solve One, two dimensional heat flow problems and one dimensional wave equation problems.	K3

TEXT BOOKS:

1. A.H.Friedberg, A.J.Insel and L.Spence, “Linear Algebra”, Prentice Hall of India, New Delhi, 2017.
2. T.Veerarajan,“Linear Algebra and Partial Differential Equations”, TataMcGrawHill,NewDelhi,2018.

REFERENCES:

1. B.S.Grewal, “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 44th Edition, 2017.
2. G.James, “Advanced Modern Engineering Mathematics”, Pearson Education, 4th Edition 2016.
3. D.C.Lay, “Linear Algebra and it’s a Applications”, 5th Edition, Pearson Education, 2018.
4. S.Kumaresan, “Linear Algebra – A Geometric Approach”, Prentice Hall of India, New Delhi, Reprint, 2018.
5. M.Chandrasekar, “Linear Algebra and Partial Differential Equations”, Vishnu Prints Media, 2nd Edition, 2019.

20EC301	ANALOG CIRCUITS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various methods of biasing in BJT, FET.
- To analyze the frequency response of small signal amplifiers.
- To learn and explain feedback amplifiers and power amplifier circuits in different modes of operation.
- To introduce the various types of oscillators and multivibrators.
- To understand the concept of small signal single and double tuned amplifiers.

PRE-REQUISITE:

Course Code: 20EC201 & 20GE204
Course Name: Network Analysis & Basic Electrical Engineering and Electron Devices

UNIT - I BIASING OF DISCRETE BJT, JFET9

BJT – Need for biasing – AC, DC Load Line and Bias Point – DC analysis of Transistor circuits - Various biasing methods of BJT – Thermal stability - Stability factors - Bias compensation techniques using diode, thermistor and sensistor – Biasing of JFET - Load Line and Bias Point - Various biasing methods of JFET.

UNIT - II SMALL SIGNAL ANALYSIS AND FREQUENCY RESPONSE 9

Small signal analysis of CE, CB and CC BJT amplifiers using Hybrid π model - Small signal analysis of CS, CD and CG JFET amplifiers using Hybrid π model. BJT frequency response – short circuit current gain – Miller effect - frequency response of FET - High frequency analysis of CE and CS amplifier.

UNIT - III FEEDBACK AMPLIFIERS AND POWER AMPLIFIERS 9

Feedback concepts – gain with feedback – effect of feedback on gain stability, distortion, bandwidth, topologies and analysis of series-series, series-shunt, shunt-series and shunt-shunt feedback amplifiers, Power amplifiers - Class A - Class B - Class AB - Class C.

UNIT - IV OSCILLATORS AND MULTIVIBRATORS 10

Barkhausen criterion for oscillation – Phase shift, Wien bridge, Hartley, Colpitt's, Clapp's and Crystal oscillators. Multivibrators: Astable – Monostable – Bistable, Clippers and Clampers – Schmitt trigger.

UNIT - V TUNED AMPLIFIERS 8

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 – Neutralization: Hazeltine neutralization method.

TOTAL: 45 PERIODS

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Analog Circuits		**Course Code :** 20EC301
CO	**Course Outcomes**	**K-CO**
C202.1	Determine the stability, Q point and D.C, A.C load line for different biasing types used for transistor operation	K3
C202.2	Derive the voltage gain, current gain for different transistor configuration by using the hybrid π model	K2
C202.3	Calculate the frequency response of BJT and FET	K3
C202.4	Explain the operation of different types of feedback amplifier and power amplifi r	K2
C202.5	Derive the frequency of oscillation and condition of oscillation of RC, LC oscillators and Multivibrators	K2
C202.6	Determine the resonant frequency and Q factor of single tuned and double tuned amplifiers.	K3

TEXT BOOKS:

1. David A. Bell, “Electronic Devices and Circuits”, Oxford University Press, 5th Edition, 2008.

2. Jacob Millman, Christos Halkias, Chetan Parikh, “Millman's Integrated Electronics - Analog and Digital Circuit and Systems”, McGraw Hill Education, 2nd Edition, 2017.

REFERENCES:

1. Sedraand Smith, “Micro Electronic Circuits”, Oxford University Press, 8thEdition, 2019.

2. Robert L. Boylestad and Louis Nasheresky, “Electronic Devices and Circuit Theory”, PHI Learning, 10th Edition, 2008.

3. Donald. A. Neamen, “Electronic Circuits Analysis and Design”, McGraw Hill Education (India) Pvt. Ltd., 3rdEdition, 2010.

4. S.Salivahanan,N.Suresh Kumar and A.Vallavaraj, “Electronic Devices and Circuits”,Mc Graw Hill, 4th Edition, 2018.
5. J.B.Gupta, “Electronic Devices and Circuits”, S.K. Kataria& sons, 6thEdition, 2016.

20EC302	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- Understand the mathematical representation of signals and systems.
- Explain the concept of Linear Time Invariant Systems and the Convolution property.
- Represent a given continuous time signal in frequency domain using Fourier Series, Fourier Transform and Laplace Transform.
- Represent a given Discrete Time Signal in frequency domain using discrete time Fourier Transform and Z-Transform.
- Understand Spectrum Analysis of Continuous Time signals and sampled version of the CT signal.

PRE-REQUISITE:

Course Code: 20BS201
Course Name: Laplace Transform and Advanced Calculus

UNIT - I CLASSIFICATION OF SIGNALS AND SYSTEMS 12

Standard signals - Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids - Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems - CT systems and DT systems – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable, Generation of elementary signals using MATLAB

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

Baseband signal Sampling – 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

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Signals and Systems		**Course Code :** 20EC302
CO	**Course Outcomes**	**K-CO**
C203.1	Classify the continuous time and discrete time signals / systems.	K3
C203.2	Determine the spectral characteristics of continuous time signal using Fourier and Laplace transform.	K3
C203.3	Compute the impulse response and output of the continuous time LTI systems using Fourier and Laplace transform.	K3
C203.4	Discuss the concept of continuous time to discrete time signals.	K2
C203.5	Determine the spectral characteristics of DT signal using discrete time Fourier and Z transform.	K3
C203.6	Compute the impulse response and output of the discrete time LTI systems using Fourier and Z transform.	K3

TEXT BOOKS:

1. Simon Haykin and Barry Van Veen, “Signalsand Systems”, Wiley, 2nd Edition, 2007.
2. B.P.Lathi and R.A.Green, “Principles of Linear Systems and Signals”, Oxford University Press, 3rd Edition, 2018.

REFERENCES:

1. Allan V. Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, Pearson, 2015.
2. Hwei P. Hsu, “Schaum Outlines - Signals and Systems Matlab Examples”, McGraw Hill, 4th Edition 2019.
3. R.E.Zeimer, W.H.Tranter and R.D.Fannin, “Signals & Systems - Continuous and Discrete”, Pearson, 2007.
4. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 2007.
5. S.Nagoorkani, “Signals and Systems - Simplified”, McGraw Hill, 1st Edition, 2018.

20EC303	DIGITAL SYSTEM DESIGN	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To design digital circuits using simplified Boolean functions
- To analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits
- To understand Programmable Logic Devices
- To write HDL code for combinational and sequential circuits

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION TO DIGITAL SYSTEM 12

Digital Systems and Binary Numbers- Octal and Hexadecimal Numbers - Boolean Algebra and Logic Gates - Gate-Level Minimization - Introduction to Map Method - Four and Five Variable K-Map - Don't-Care Conditions - Tabulation Method. Introduction to Hardware Description Language: module description, gate delays, Boolean expressions, User Defined Primitives

UNIT - II COMBINATIONAL LOGIC 12

Introduction of Combinational Circuits - Analysis Procedure: Deriving truth table and logic diagram for few examples - Design Procedure: Binary Adder/Subtractor - Half adders, Full adders, Parallel adder, Carry Look ahead adder, Binary subtractor - Code converters - Magnitude Comparators – Encoder - Priority encoder – Decoder - Decimal Adder - Binary Multiplier – Multiplexers - Demultiplexers - HDL Models of Combinational Circuits: Gate level modeling, Data flow modeling, Behavioralmodeling, Writing test bench for simple logics

UNIT - III SYNCHRONOUS SEQUENTIAL LOGIC 12

Storage Elements: Latches - Flip-Flops - Analysis of Clocked Sequential Circuits – Analysis Examples with D, T and JK flip-flops - Moore and Mealy Finite State Machines - Synthesizable HDL Models of Sequential Circuits – HDL model for Flip-Flops, Latches, HDL Model of ZERO detector (Moore/Mealy model) - State Reduction and Assignment - Design Procedure - Shift Registers – SISO, SIPO, PIPO, PISO, Universal shift register – Counters - Ripple and Synchronous Counters, Ring counter, Jhonson counter - HDL for Registers and Counters

UNIT - IV ASYNCHRONOUS SEQUENTIAL LOGIC 12

Introduction - Analysis Procedure - Analysis of SR based NOR and NAND - Analysis of circuit using SR Latch - Design Procedure - Reduction of state table and primitive flow table - Implication, merging of flow table, compatible pairs, maximal compatibles, closed covering conditions - Race-free state assignment - three row, four row and multiple row flow table examples – Hazards - Hazards in combinational and sequential logic circuits, Essential Hazards - Design of hazard-free logic circuits

UNIT - V MEMORY AND PROGRAMMABLE LOGIC 12

Introduction - Random-Access Memory - Read/Write operation - Memory description in HDL - Memory Decoding - Address Multiplexing - Error Detection and Correction - Hamming Code - Read-Only Memory - Programmable Logic Array - Programmable Array Logic - Design of various combinational logic circuits using Programmable Logic Devices

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Digital System Design		**Course Code :** 20EC303
CO	**Course Outcomes**	**K-CO**
C204.1	Summarize different types of number systems such as Binary, BCD, Octal and Hexadecimal and conversion between them.	K3
C204.2	Apply Boolean laws and reduction techniques namely k-map and tabulation method to minimize the number of literals in a Boolean expression.	K3
C204.3	Design combinational circuits like Adders, Subtractors, Encoders, Magnitude Comparators, Multipliers, Multiplexers by using logic gates and Design sequential circuits like Registers and counters by using Flip-flops.	K3
C204.4	Analyze Asynchronous sequential circuits and design a hazard-free logic.	K4
C204.5	Construct various Programmable Logic Devices with logic gates and Implement combinational logics in Programmable Logic Devices.	K3
C204.6	Demonstrate Combinational and Sequential logic circuits by using Verilog Description Language and Demonstrate Finite State Machines by using Verilog Description Language.	K3

TEXT BOOKS:

1. M.Morris R. Mano and Michael D. Ciletti, “Digital Design: With an Introduction to the Verilog HDL”, Pearson Education, 5th Edition, 2012.
2. D.P.Leach and A.P.Malvino, “Digital Principles and Applications”, Tata Mc Graw Hill, 2011.

REFERENCES:

1. M. Morris R. Mano, “Digital Design”, Pearson Education, 3rd edition, 2002.
2. G.K.Kharate, “Digital Electronics”, Oxford University Press, 2010.
3. John F. Wakerly, “Digital Design Principles and Practices”, Pearson Education, 5th Edition, 2017.
4. Charles H. Roth Jr and Larry L. Kinney, “Fundamentals of Logic Design”, CENGAGE Learning, 6th Edition, 2013.
5. Donald D. Givone, “Digital Principles and Design”, Tata Mc Graw Hill, 2003.
6. R.P.Jain, “Modern Digital Electronics”, Tata Mc-Graw Hill, 1995.

20HS301	UNIVERSAL HUMAN VALUES	L	T	P	C
		2	1	0	3

OBJECTIVES:

- To create an awareness on Engineering Ethics and Human Values.
- To understand social responsibility of an engineer.
- To appreciate ethical dilemma while discharging duties in professional life.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION TO VALUE EDUCATION 9

Value Education – Definition - Concept and Need for Value Education - The Evolution of Value Education: Natural acceptance, Self exploration - Fundamentals of value education - Happiness and Prosperity as parts of Value Education- fulfilling human aspirations.

Practice sessions: To discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT - II HARMONY IN THE HUMAN BEING 9

Human being vs Value education – I' and Body synchronization - Understanding Myself as Co-existence of the Self and the Body - Realization - Self, Body needs - Scanning of Karma - Self and Body - Understanding Sanyam and Health.

Practice sessions: To discuss the role others have played in making material goods available to self. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

UNIT - III HARMONY IN THE FAMILY, SOCIETY AND NATURE 9

Family as a basic unit of Human Interaction - Values in Relationships - The Basics for Trust and Respect in today's Crisis: Affection, e-Guidance, Reverence, Glory, Gratitude and Love – Harmony in society : Resolution, Prosperity, Fearlessness and Co-existence as Comprehensive Human Goal - Harmony in Nature: The Four Orders in Nature - The Holistic Perception of Harmony in Existence.

Practice sessions: To discuss on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education. Gratitude as a universal value in relationship. Discuss with scenarios. Elicit examples from students' lives

UNIT - IV SOCIAL ETHICS 9

The Basics for Ethical Human Conduct - Defects in Ethical Human Conduct - Holistic Alternative and Universal Order - Universal Human Order and Ethical Conduct - Human Rights violation and Social Disparities.

Practice sessions: To discuss human being as cause of imbalance in nature, pollution, depletion of resources and role of technology

UNIT - V PROFESSIONAL ETHICS 9

Value based Life and Profession - Professional Ethics and Right Understanding - Competence in Professional Ethics - Issues in Professional Ethics – The Current Scenario - Vision for Holistic Technologies, Production System and Management Models.

Practice sessions: To discuss the conduct as an engineer or scientist

TOTAL: 45 PERIODS

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO

Course Name : Universal Human Values		**Course Code :** 20HS301
CO	**Course Outcomes**	**K-CO**
C205.1	Explain the significance of value inputs in a classroom and summarize human aspirations.	AD
C205.2	Distinguish between Values & Skills to ensure happiness and prosperity.	AD
C205.3	Identify the synchronization between Thyself & the Body to ensure competency of an individual	AD
C205.4	Generalize the role of a human being in ensuring harmony in society and nature.	AD
C205.5	Distinguish between ethical and unethical practices and analyze harmonious social environment.	AD
C205.6	Assess the importance of value based life and evaluate the role of professional ethics.	AD

TEXT BOOKS:

1. R.R.Gaur, R. Sangal and G.P. Bagaria, “A Foundation Course in Human Values and Professional Ethics”, Excel Books, 2nd Revised Edition, New Delhi, Re-print 2019.
2. A.N. Tripathy, “Human Values”, New Age International Publishers, New Delhi, 2003.

REFERENCES:

1. E.G.Seebauer and Robert L. Berry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, 2000.
2. M.Govindrajran, S.Natrajan and V.S.Senthil Kumar, “Engineering Ethics (including Human Values)”, Eastern Economy Edition, Prentice Hall of India Ltd., 2004.
3. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw Hill, New York, 1996.
4. Charles E. Harries, Michael S. Protchard and Michael J. Rabins, “Engineering Ethics - Concepts and Cases”, Thomson Learning, 2000.
5. S.K.Chakraborty and Dabangshu Chakraborty, “Human Values and Ethics: Achieving Holistic Excellence”, ICFAI University Press, 2006.

20CS303	OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To introduce the fundamentals of object oriented programming using C++.
- To implement object oriented programming concepts.
- To introduce linear data structures and their applications.
- To introduce non-linear data structures and their applications.
- To implement sorting and searching algorithms.

PRE-REQUISITE:

Corse Code**:** 20GE2L2

Course Name: Unix and Shell Scripting Laboratory

UNIT - I BASIC CONCEPTS OF OBJECT ORIENTED PROGRAMMING 9

Overview of C++ – Structures – Tokens – Expressions - Control Structures - Classes and Objects - Class Scope and Accessing Class Members – Reference Variables – Constructors – Destructors – Member Functions and Classes – Friend Function – Dynamic Memory Allocation – Static Class Members – Overloading: Function overloading and Operator overloading.

LAB COMPONENT

1. Develop a C++ program using classes and constructors.
2. Develop a C++ program for implementing function and operator overloading. **6**

UNIT - II INHERITANCE AND POLYMORPHISM 9

Base Classes and Derived Classes – Protected Members – Casting Class pointers and Member Functions – Overriding – Public, Protected and Private Inheritance – Constructors and Destructors in derived Classes – This Pointer – Dynamic Binding - Virtual functions and polymorphism - File handling - Exception Handling - manipulating Strings.

LAB COMPONENT

1. Develop C++ program for implementing the different types of inheritance. **6**
2. Develop C++ program for implementing polymorphism.

UNIT - III LINEAR DATA STRUCTURES 9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – singly linked lists – Polynomial Manipulation – Stack ADT – Evaluating arithmetic expressions – Queue ADT - priority Queue.

LAB COMPONENT

1. Perform polynomial manipulation using list.
2. Develop C++ program to implement stack and queue data structures and their operations. **6**

UNIT - IV NON-LINEAR DATA STRUCTURES 9

Trees – Binary Trees – Binary tree representation and traversals – Binary Search Trees - AVL Trees – Graph and its representations – Graph Traversals – Representation of Graphs – Topological sort - Breadth-first search – Depth-first search – Minimum Spanning Tree.

LAB COMPONENT

1. Develop C++ program for implementation of AVL Trees.
2. Develop C++ program for implementation of Graph Traversals Using Breadth-First Search and Depth-First Search **6**

UNIT - V SORTING AND SEARCHING **9**

Sorting algorithms: Insertion sort – Shell sort - Heap sort - Quick sort – Merge sort – Searching: Linear search – Binary Search - Introduction to Algorithm design techniques – Backtracking - Dynamic programming - Greedy Algorithm - Divide and Conquer.

LAB COMPONENT

1. Develop C++ program for linear search and binary search.
2. Develop C++ program for quick sort and merge sort. **6**

TOTAL: 75 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Object Oriented Programming and Data Structures		**Course Code :** 20CS303
CO	**Course Outcomes**	**K-CO**
C206.1	Explain the concept of C++.	K2
C206.2	Implement the concepts of Inheritance.	K3
C206.3	Implement the concepts of Polymorphism.	K3
C206.4	Apply the linear data structures like Stack and Queue to various computing problems.	K3
C206.5	Implement the Non-linear data structures like trees and its applications.	K3
C206.6	Implement the Non-linear data structures like graphs and its applications.	K3
C206.7	Implement the sorting and searching algorithms.	K3
C206.8	Apply the algorithm design techniques.	K3

TEXT BOOKS:

1. Deitel and Deitel, “C++, How To Program”, Pearson Education, 10th Edition, 2017.
2. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C++”, Addison Wesley, 4th Edition, 2014.

REFERENCES:

1. Bhushan Trivedi, “Programming with ANSI C++, A Step-By-Step approach”, Oxford University Press, 2010.
2. Goodrich, T.Michael, Roberto Tamassia and David Mount, “Data Structures and Algorithms in C++”, Wiley, 7th Edition, 2004.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, Mc Graw Hill, 2nd Edition, 2002.
4. Bjarne Stroustrup, “The C++ Programming Language”, Pearson Education, 3rd Edition, 2007.
5. Ellis Horowitz, Sartaj Sahni and Dinesh Mehta, “Fundamentals of Data Structures in C++”, Galgotia Publications, 2007.

20EC3L1 ANALOG CIRCUITS LABORATORY

L	T	P	C
0	0	3	1.5

OBJECTIVES:

- To design a regulated power supply.
- To study the frequency response of CE and CS amplifier.
- To study the operation of feedback amplifiers and oscillators.
- To learn the operation of wave shaping circuits and Multivibrators.
- To simulate various circuits using SPICE.

LIST OF EXPERIMENTS

DESIGN AND ANALYSIS OF THE FOLLOWING CIRCUITS:

1. Design of regulated power supply
2. Frequency response of CE and CS amplifiers
3. RC Coupled Cascaded CE amplifier
4. Series and Shunt feedback amplifiers - Frequency response
5. Single Tuned Amplifier
6. RC Phase Shift Oscillator
7. Hartley Oscillator and Colpitts Oscillator
8. Astable and Monostable Multivibrators
9. Clippers and Clampers

SIMULATION USING SPICE (USING TRANSISTOR):

10. Analysis of BJT, FET with Fixed bias and Voltage divider bias
11. Twin-T Oscillator
12. Double Tuned Amplifiers
13. Bistable Multivibrator
14. Schmitt Trigger circuit

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO

Course Name : Analog Circuits Laboratory		**Course Code :** 20EC3L1
CO	**Course Outcomes**	**K-CO**
C207.1	Design and test rectifiers, filters, regulated power supplies and frequency response of BJT/FET.	K6
C207.2	Design and measure the frequency response of Series and Shunt feedback amplifiers and a single tuned amplifier.	K6
C207.3	Design of various types of oscillators.	K6
C207.4	Design of wave shaping circuits and Multivibrators.	K6
C207.5	Analyze the frequency response of BJT, FET and Tuned amplifiers by using spice.	K4
C207.6	Analyze the frequency of oscillation for Oscillators and Multivibrators by using spice.	K4

LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS

1. CRO/DSO – 15 Nos.
2. Signal Generator / Function Generators – 15 Nos.
3. Dual Regulated Power Supplies – 15 Nos.
4. Desktop PCs with SPICE software – 15 Nos.
5. Transistor/FET (BJT – NPN – PNP, NMOS/PMOS) – 50 Nos.
6. PN Junction Diodes – 50 Nos.
7. Digital Multimeter – 15 Nos.
8. Digital LCR Meter – 2 Nos.
9. Decade Resistance Box – 10 Nos.
10. Decade Inductance Box – 10 Nos.
11. Decade Capacitance Box – 10 Nos.
12. IC-7805 – 15 Nos.
13. SPICE Circuit Simulation Software: (any public domain or commercial software)

Components and Accessories:

Transistors, Resistors, Capacitors, Inductors, Diodes, Zener Diodes, Bread Boards, Transformers.

20EC3L2 DIGITAL SYSTEM DESIGN LABORATORY

L	T	P	C
0	0	3	1.5

OBJECTIVES:

- To understand the various components used in the design of digital computers.
- To construct and verify the truth table of digital circuits in accordance with Boolean Laws.
- To design and construct different combinational and sequential circuits and verify its functionality.
- To write HDL code for combinational and sequential circuits and able to familiar with virtual experimentation.

LIST OF EXPERIMENTS

1) Verification of Boolean Theorems using basic gates.
2) Design and implementation of Half Adder and Full Adder using basic gates.
3) Design and implementation of Code Converters using basic gates.
4) Design and implementation of 4 – bit binary adder / subtractor using MSI.
5) Design and implementation of 4 – bit BCD adder using MSI.
6) Design and implementation of parity generator / checker using basic gates and MSI.
7) Design and implementation of magnitude comparator using basic gates and MSI.
8) Design and implementation of combinational circuits / Boolean expressions by using Multiplexers MSI.
9) Design and implementation of 4 bit SISO, SIPO, PIPO, PISO Shift registers using Flip-Flops.
10) Design and implementation of synchronous counters using Flip-Flops.
11) Design and implementation of asynchronous counters using Flip-Flops.
12) Simulation of Half Adder and Full Adder, Multiplexers, Counters using Verilog HDL

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Digital System Design Laboratory		**Course Code :** 20EC3L2
CO	**Course Outcomes**	**K-CO**
C208.1	Construct digital circuits with minimum number of gates by applying Boolean laws.	K3
C208.2	Construct combinational circuits like adders, code-converters, parity error checker and magnitude comparators by using logic gates / MSI with respect to the design specifications.	K3
C208.3	Realize the application of multiplexers by implementing various combinational logic / Boolean expressions with the help of multiplexers.	K3
C208.4	Construct and verify the function table of 4-bit SISO, SIPO, PIPO, PISO shift registers using D Flip-Flops.	K3
C208.5	Construct synchronous and asynchronous counters by using Flip-Flops as per the design specifications.	K3
C208.6	Model the adders, multiplexers, registers and counters with Verilog HDL.	K3

LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS

HARDWARE: 1. Digital trainer kits 30 Nos.
2. Digital ICs required for the experiments in sufficient numbers

SOFTWARE: 1. HDL simulator.

20EC401 RANDOM PROCESS AND INFORMATION THEORY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide necessary basic concepts in probability and random variables for applications in communication engineering.
- To understand the basic concepts of random processes.
- To understand the concept of correlation and spectral densities.
- To understand the significance of linear systems with random inputs.
- To know the effect of noise on communication systems.

PRE-REQUISITE:

Course code:20EC302
Course Name: Signals and Systems

UNIT - I PROBABILITY AND RANDOM VARIABLES 9

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 VARIABLE AND RANDOM PROCESSES 9

Joint distributions – Marginal and conditional distributions – Covariance, Correlation - Random Process: Basic concepts - Stationary Processes - Mean, Correlation and Covariance functions - Properties - Ergodic Processes.

UNIT - III LINEAR SYSTEMS WITH RANDOM INPUTS 9

Transmission of Random Process over LTI Systems - Random Processes in the Frequency Domain, Power spectral density – Properties - Cross spectral density – Gaussian Processes – Properties - Central limit theorem.

UNIT - IV NOISE 9

Noise sources and types - White Noise - Narrow band Noise - Representation of Narrow band noise – in-phase and quadrature Phase components - Envelope and phase Components - Sine wave plus narrow band noise.

UNIT - V INFORMATION THEORY 9

Discrete Memory less Source - Information, Entropy - Source coding theorem - Data Compaction - Huffman code - Shannon fano code - Discrete memory less channel - Mutual Information - Channel capacity - Channel coding Theorem - Information capacity theorem.

TOTAL: 45 PERIODS

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Random Process and Information Theory		**Course Code :** 20EC401
CO	**Course Outcomes**	**K-CO**
C209.1	Apply the concepts of probability and standard distributions with real life phenomenon.	K3
C209.2	Apply the concept of random processes to the design of communication systems.	K3
C209.3	Apply the concept of correlation and spectral densities to derive the response of LTI system for random Inputs.	K3
C209.4	Explain the effect of noise on communication systems.	K3
C209.5	Calculate information, Entropy, Mutual Information and channel capacity for the given channel.	K3
C209.6	Compute the coding using source coding schemes.	K3

TEXT BOOKS:

1. O.C.Ibe, “Fundamentals of Applied Probability and Random Processes”, Elsevier, 1st Indian Reprint, 2007.
2. Simon Haykin, “Communication Systems”, Wiley, 4th Edition, 2014.

REFERENCES:

1. J.G.Proakis and M.Salehi, “Fundamentals of Communication Systems”, Pearson Education 2014.
2. P.Z.Peebles, “Probability, Random Variables and Random Signal Principles”, Tata McGraw Hill, 4th Edition, New Delhi, 2002.
3. Hwei Hsu, “Schaum’s Outline of Theory and Problems of Probability, Random Variables and Random Processes”, Tata McGraw Hill Edition, New Delhi, 2004.
4. S.L.Miller and D.G.Childers, “Probability and Random Processes with Applications to Signal Processing and Communications”, Academic Press, 2004.
5. B.P.Lathi, “Modern Digital and Analog Communication Systems” Oxford University Press, 4th Edition, 2017.
6. H.P.Hsu, “Schaum Outline Series - Analog and Digital Communications”, TMH 2006.

20EC402 COMPUTER ARCHITECTURE AND ORGANIZATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the organization of the various functional units and components of computers.
- To identify the elements of modern instruction sets and their impact on processor design.
- To create control units for the system with soft and hard programming.
- To explain the function of each element of a memory hierarchy.
- To understand the concepts of parallel processors and multiprocessors.

PRE-REQUISITE:

Course code: 20EC303
Course Name: Digital System Design

UNIT - I COMPUTING ELEMENTS & ARITHMETIC SYSTEM 9

Elements of Computers and its Limitations - Processor Level Components & Design - CPU Organization - Operations and Operands of the Computer Hardware - Arithmetic for computers - Parallelism and Subword Parallelism - Fallacies and Pitfalls.

UNIT - II PROCESSOR DESIGN 9

Logic Design Conventions – Data path Implementation Scheme - Combinational and Sequential ALUs - Robertson algorithm - Booth's algorithm - Modified Booth's Algorithm - Pipelined Datapath and Control - Data Hazards - Control Hazards – Exceptions - Parallelism via Instructions.

UNIT - III CONTROL DESIGN 9

Hardwired Control - Classical Method - One-hot method - Encoding Methods - Microprogrammed Control - Multiplier Control Unit - CPU Control Unit - Pipeline Control - Instruction Pipelines - Pipeline Performance - Superscalar Processing and Nano Programming.

UNIT - IV MEMORY HIERARCHY 9

Memory Technologies - Basics of Caches - Measuring and Improving Cache Performance - Dependable Memory Hierarchy - Virtual Machines - Virtual Memory - Framework for Memory Hierarchy - Cache Coherence - Cache Controllers.

UNIT - V PARALLEL PROCESSORS 9

Introduction - SISD, MIMD, SIMD, SPMD, and Vector processors - Hardware Multithreading - Multicore and Other Shared Memory Multiprocessors - Introduction to Graphics Processing Units - Clusters - Warehouse Scale Computers, and Other Message-Passing Multiprocessors - Introduction to Multiprocessor Network Topologies.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Computer Architecture and Organization		**Course Code :** 20EC402
CO	**Course Outcomes**	**K-CO**
C210.1	Describe the fundamental organization of a computer system.	K2
C210.2	Illustrate the functional units of a processor and its constraints.	K3
C210.3	Develop architectures required for control path design.	K3
C210.4	Categorize the various parts of a system memory hierarchy.	K2
C210.5	Describe the basic concepts of parallel computing, pipelining and vector processing system.	K2
C210.6	Demonstrate the computer architecture concepts related to the design of modern processors, memories and commercially available computers.	K3

TEXT BOOKS:

1. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The hardware / software interface”, 5th Edition, Morgan Kaufmann, Waltham, 2014.
2. John P.Hayes, “Computer Architecture and Organization”, 3rd Edition, Tata McGraw–Hill, 2012.

REFERENCES:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, “Computer Organization and Embedded Systems”, 6th Edition, Mc-Graw Hill, New York, 2012.
2. Morris Mano, “Computer System Architecture”, 3rd Edition, Pearson Education, 2008.
3. P.PalChaudhuri, “Computer Organization and Design”, 3rd Edition, Prentice Hall of India, 2009.
4. John L. Hennessy and David A. Patterson, “Computer Architecture - A Quantitative Approach”, Morgan Kaufmann, Waltham, 2012.
5. John Paul Shen and Mikko H. Lipasti, “Modern Processor Design – Fundamentals of Superscalar Processors”, Waveland Press, Inc., Long Grove, 2013.

20EC403	ELECTROMAGNETIC FIELDS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To introduce students with different coordinate systems.
- To familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagneticsystems.
- To expose the students to the ideas of electromagnetic waves.

PRE-REQUISITE:

Course Code: 20BS101, 20BS201 &20BS203
Course Name: Fundamentals of Engineering Mathematics, Laplace Transform and Advanced Calculus & Physics for Electronics Engineering

UNIT - I INTRODUCTION 12

Review of vector algebra: Scalars and Vectors -Unit Vector -Vector Addition and Subtraction -Position and Distance Vectors -Vector Multiplication - Components of a Vector
Coordinate systems and transformation: Introduction - Cartesian Coordinates - Circular Cylindrical Coordinates - Spherical Coordinates - Constant-Coordinate Surfaces
Vector calculus: Introduction -Differential Length, Area, and Volume -Line, Surface, and Volume Integrals - Del -Gradient of a Scalar -Divergence of a Vector and Divergence Theorem -Curl Operator of a Vector and Stokes's Theorem -Laplacian of a Scalar - Classification of Vector Fields

UNIT - II ELECTROSTATICS 12

Electrostatic fields: Introduction - Coulomb's Law and Field Intensity - Electric Fields due to Continuous Charge Distributions - Electric Flux Density - Gauss's Law - Maxwell's Equation - Applications of Gauss's Law - Electric Potential - Relationship between E and V - Maxwell's Equation -An Electric Dipole and Flux Lines - Energy Density in Electrostatic Fields - Application Note -Electrostatic Discharge - Electric Field Plotting using MATLAB
Electric fields in material space: Introduction - Properties of Materials - Convection and Conduction Currents – Conductors - Polarization in Dielectrics - Dielectric Constant and Strength - Linear, Isotropic, and Homogeneous Dielectrics - Continuity Equation and Relaxation Time - Boundary Conditions - Application Note - Materials with High Dielectric Constant
Electrostatic Boundary Conditions: Introduction - Poisson's and Laplace's Equations - Uniqueness Theorem - General Procedures for Solving Poisson's or Laplace's Equation - Resistance and Capacitance

UNIT - III MAGNETOSTATICS 12

Magnetostatic Fields: Introduction -Biot–Savart's Law -ampere's circuit law - Maxwell's equation -applications of ampere's law -magnetic flux density - Maxwell's equation - Maxwell's equations for static fields - magnetic scalar and vector potentials -derivation of Biot–savart's law and Ampere's law
Magnetic Forces, Materials, and Devices: Introduction -forces due to magnetic fields - magnetic torque and moment -a magnetic dipole -magnetization in materials -classification of materials -magnetic boundary conditions -inductors and inductances -magnetic energy - magnetic circuits -force on magnetic materials

UNIT - IV MAXWELL's EQUATIONS 12

Introduction - Faraday's Law - Transformer and Motional Electromotive Forces - Displacement Current - Maxwell's Equations in Final Forms - Time-Varying Potentials - Time-Harmonic Fields

UNIT - V ELECTROMAGNETIC WAVE PROPAGATION 12

Introduction - Waves in General - Wave Propagation in Lossy Dielectrics - Plane Waves in Lossless Dielectrics - Plane Waves in Free Space - Plane Waves in Good Conductors - Wave Polarization - Power and the Poynting Vector - Reflection of a Plane Wave at Normal Incidence - Reflection of a Plane Wave at Oblique Incidence

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Electromagnetic Fields		**Course Code :** 20EC403
CO	**Course Outcomes**	**K-CO**
C211.1	Define and recognize different co-ordinate systems to describe the spatial variations of the physical quantities dealt in electromagnetic field theory as they are functions of space and time. Apply different techniques of vector calculus to understand different concepts of electromagnetic field theory.	K3
C211.2	Explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields (Field intensity, Flux density etc.) in different media using the fundamental laws.	K3
C211.3	Determine the electromagnetic force exerted on charged particles, current elements, working principle of various electric and electromagnetic energy conversion devices.	K3
C211.4	Design electromagnetic energy storage devices like capacitor, inductor which are frequently used in electrical systems	K3
C211.5	Determine the concepts and equations of electromagnetic waves, means of transporting energy or information, in the form of radio waves	K3
C211.6	Deduce the concepts and equations of electromagnetic wave propagation in different media.	K4

TEXT BOOKS:

1. Mathew N.O. Sadiku, “Elements of Electromagnetic”, Oxford UniversityPress, 4th Edition, 2015.
2. W.H. Hayt and J.A. Buck, “Engineering Electromagnetics”, McGraw-Hill (India), 8th Edition, 2011.

REFERENCES:

1. D.K. Cheng, “Field and wave electromagnetics”, Pearson (India), 2nd edition, 1989.
2. Griffiths, “Introduction to electrodynamics”, Pearson (India), 4th edition, 2013.
3. K. A. Gangadhar, P.M. Ramanathan, “Electromagnetic Field Theory”, Khanna Publishers, 8th edition, 2015.
4. Nannapaneni Narayana Rao, “Elements of Engineering Electromagnetics”, Pearson education, 6th edition, 2004.

20EC404	ANALOG ELECTRONICS AND INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of voltage regulators and 555 timers
- To introduce the basic building blocks of linear integrated circuits
- To learn the linear and non-linear applications of operational amplifiers
- To introduce the theory and applications of PLL and data converters

PRE-REQUISITE:
Course Code: 20EC301
Course Name: Analog Circuits

UNIT - I VOLTAGE REGULATORS AND 555 TIMER 9

Voltage regulators: Linear mode power supply - Rectifiers - Half-Wave Rectifier - Full-Wave Rectifiers - Filters - Voltage regulation - Linear series and shunt Voltage Regulators. Series op-amp regulator - IC voltage regulator: Fixed and adjustable voltage regulators – IC723 general purpose regulator.
555 timer: Monostable multivibrators – Astable multivibrators – Application.

UNIT - II BASICS OF OPERATIONAL AMPLIFIER 9

Introduction and classification of IC – Basic information about Op-amp – Internal circuit diagram of IC 741 - general operational amplifier stages - Differential amplifier - Low frequency small signal analysis - Constant current mirror and Current sources - ideal op-amp characteristics – open and closed loop configurations – DC and AC characteristics.

UNIT - III APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Sign changer, Scale changer, Phase shift circuits, voltage follower, V-to-I and I-to-V converters, adder, subtractor, Differential amplifier, Instrumentation amplifier, Integrator, Differentiator, Multiplier, Logarithmic amplifier, Antilogarithmic amplifier, Voltage to Frequency and Frequency to Voltage converter, Precision rectifier, peak detector, clipper and clamper, Active filters: Low pass, High pass and Band pass.

UNIT - IV COMPARATORS AND WAVEFORM GENERATORS 9

Comparator: Open loop Op-amp configuration – Inverting and Non-inverting comparator – Applications of comparator - Regenerative comparator (Schmitt trigger)
Waveform generators: Principles of sine wave generators – RC phase shift and Wein bridge oscillator, Multivibrators – Astable and Monostable multivibrator, triangular waveform and sawtooth waveform generator

UNIT - V PLL AND DATA CONVERTERS 9

PLL: Block diagram – Operation of basic PLL, closed loop analysis - voltage controlled oscillator –Monolithic PLL IC 565 – Applications of PLL.
Data converters: D/A converters – specifications – weighted resistor type, R-2R ladder - Inverted R-2R ladder – High speed sample and hold circuits. A/D converters – Specifications – Flash type – successive approximation type – counter ramp – Dual slope type.

TOTAL: 45 PERIODS

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Analog Electronics and Integrated Circuits		**Course Code :** 20EC404
CO	**Course Outcomes**	**K-CO**
C212.1	Explain the characteristics of an operational amplifier.	K2
C212.2	Design the operational amplifier circuits for various linear and non-linear applications.	K3
C212.3	Design waveform generator circuits using Op-amp comparator.	K3
C212.4	Explain the basics of PLL and its applications.	K2
C212.5	Design the ADC and DAC using op-amps.	K3
C212.6	Explain the functional operations and applications of 555 timer circuits and IC voltage regulators.	K2

TEXT BOOKS:

1. D.Roy Choudhry and Shail Jain, “Linear Integrated Circuits”, New Age International pvt. Ltd., 5th Edition, 2018.
2. J.B.Gupta, “Electronic Devices and Circuits”, S.K. Kataria& sons, 6th Edition, 2016.

REFERENCES:

1. Sergio France, “Design with operational amplifiers and analog integrated circuits”, Tata McGraw-Hill, 4th Edition, 2016.
2. S.Salivahanan and V.S.KanchanaBhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill, 2nd Edition (4th reprint), 2016.
3. Ramakant A. Gayakwad, “Op-amp and Linear ICs”, Prentice Hall / Pearson Education, 4th Edition, 2015.
4. Robert F. Coughlin and Frederick F. Driscoll, “Operational amplifiers and linear integrated circuits”, PHI, 6th Edition, 2001.
5. B.S.Sonde, “System design using Integrated circuits”, New Age publications, 2nd Edition, 2001.
6. Gray and Meyer, “Analysis and Design of Analog Integrated circuits”, Wiley International, 5th Edition, 2009.
7. William D. Stanley, “Operational amplifiers with Linear Integrated circuits”, Pearson Education, 4th Edition, 2001.

20HS401 ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To study the scope and significance of environment.
- To understand the interrelationship between living organism and environment.
- To get a conceptual knowledge on various types of pollution and its effects.
- To gain knowledge on various natural resources and its significances.
- To provide knowledge on solid wastes, disposal methods and natural disasters and its management.
- To learn social issues such as human welfare, sustainability related to population.

PRE-REQUISITE:NIL

UNIT - I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY **6**

Environment – definition, importance, public awareness
Ecosystem – concept, structure and function – producers, consumers and decomposers - characteristic features, structure and function of the forest ecosystem and grassland ecosystem **Biodiversity** – definition, types - genetic, species and ecosystem diversity – values - consumptive use, productive use, social, ethical, aesthetic and option values – hotspots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, endangered and endemic species of India. Assignment on conservation of biodiversity.

UNIT - II ENVIRONMENTAL POLLUTION **6**

Definition, causes, effects and control measures of (i) Air pollution (ii) Water pollution (iii) Soil pollution (iv) Marine pollution – role of an individual in prevention of pollution – pollution case studies - Climate change - global warming, acid rain, ozone layer depletion.

UNIT - III NATURAL RESOURCES **6**

Forest resources: Uses, over-exploitation, deforestation, case studies
Water resources: Surface water and ground water - uses, over-utilization, conflicts over water, Conservation of water – rain-water harvesting, dams-benefits and problems
Mineral resources: uses, over exploitation, environmental effects of extracting mineral resources, case studies.

UNIT - IV SOLID WASTE AND DISASTER MANAGEMENT **6**

Solid Waste Management: Introduction, types, effects on human beings and disposal management.
Disaster Management: Introduction, causes, effects and management of flood, cyclone, earthquake, landslide disasters – Case studies - roles and responsibilities of Government and Community

UNIT - V HUMAN POPULATION AND SOCIAL ISSUES **6**

Population growth, population explosion – family welfare programme – women and child welfare – human rights – value education – sustainable development – resettlement and rehabilitation – waste land reclamation – role of information technology in environment and human health. Debate on women and child welfare.

TOTAL: 30 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Environmental Science and Engineering		**Course Code :** 20HS401
CO	**Course Outcomes**	**K-CO**
C213.1	Describe the environment, ecosystem and their significances.	K2
C213.2	Explain the threats to biodiversity.	K2
C213.3	Describe the sources, effects, control methods of environmental pollution.	K2
C213.4	Explain the knowledge on various natural resources and its effect on environment due to over utilization.	K2
C213.5	Describe the disposal techniques of solid waste and record the consequences of natural disasters.	K2
C213.6	Outline the social issues as welfare, sustainability etc., and relate with population growth.	K2

TEXT BOOKS:

1. Anubha Kaushik and C.P.Kaushik, “Environmental Science and Engineering”, New Age International (P) Ltd, 6th Edition, 2018.
2. Benny Joseph, “Environmental Science and Engineering”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2006.

REFERENCES:

1. ErachBharucha, “Text book of Environmental Studies”, Universities Press (I) Pvt. Ltd., Hyderabad, 2015.
2. G.Tyler Miller and Scott E. Spoolman, “Environmental Science”, Cengage Learning India Pvt. Ltd., Delhi, 2014.
3. Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, Pearson Education, 2nd Edition, 2004.

20EC405	PRINCIPLES OF DIGITAL SIGNAL PROCESSING	L	T	P	C
		2	1	2	4

OBJECTIVES:

- To learn Discrete Fourier Transform, its properties and its application to linear filtering
- To understand the characteristics of digital filters, design of FIR and IIR filters and its realization
- To understand the effects of finite precision representation on digital filters
- To learn the fundamental concepts of Multirate signal processing

PRE-REQUISITE:

Course Code: 20EC302
Course Name: Signals and Systems

UNIT - I DISCRETE FOURIER TRANSFORM **9**

Review of DTFT –Frequency – Domain sampling: The Discrete Fourier Transform – Properties of DFT – Linear filtering methods based on the DFT – Efficient computation of the DFT: FFT algorithms: Radix 2 FFT algorithms.

LAB COMPONENT

1. Sampling and Aliasing
2. Spectrum Analysis of DFT and FFT of a discrete time sequence (Using SCILAB or Python) **6**

UNIT - II FINITE IMPULSE RESPONSE FILTERS **9**

Characteristics of practical frequency selective filters - Design of FIR filters: symmetric and Anti-symmetric FIR filters - Design of linear phase FIR filters using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. Structures for FIR systems - linear phase structure, direct form realizations.

LAB COMPONENT

Design of FIR filters – LPF, HPF, BPF, BSF using windowing method and analyzing its frequency spectrum (Using SCILAB or Python) **6**

UNIT - III INFINITE IMPULSE RESPONSE FILTERS **9**

Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters: Impulse invariance method, Bilinear transformation. Structure of IIR systems – Direct form structures, Cascade and parallel structures.

LAB COMPONENT

Design of IIR filters using Butterworth and Chebyshev filters and analyzing its frequency spectrum (Using SCILAB or Python) **6**

UNIT - IV FINITE WORD LENGTH EFFECTS **9**

Representation of Numbers – Quantization of filter coefficients – Round-off effects in Digital filters: Limit cycle oscillations in recursive systems – scaling to prevent overflow.

LAB COMPONENT

1. Fixed and Floating point representation of a discrete time sequence
2. Analyzing Quantization effect of a given signal (Using SCILAB or Python) **6**

UNIT - V MULTIRATE DIGITAL SIGNAL PROCESSING **9**

Introduction – Decimation by a factor D – Interpolation by a factor I – Sampling rate conversion by a rational factor I/D – Implementation of sampling rate conversion – Multistage implementation of sampling rate conversion.

LAB COMPONENT

1. Program for implementing a decimation and interpolation
2. Linear phase FIR interpolation and decimation filter to interpolate a signal by a factor of L **6**

TOTAL: 75 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Principles of Digital Signal Processing		**Course Code :** 20EC405
CO	**Course Outcomes**	**K-CO**
C214.1	Compute DFT and IDFT coefficients of a discrete time sequence using FFT algorithms and output of the discrete time system	K3
C214.2	Analyze the spectral components in the audio signal	K4
C214.3	Construct and realize FIR digital filters	K3
C214.4	Construct and realize IIR digital filters	K3
C214.5	Analyze the spectrum of the various types of digital filter outputs	K4
C214.6	Identify the effect of quantization error in the implementation of digital filter	K2
C214.7	Analyze the fixed point / floating point quantization error and multirate sampling converter using MATLAB / SCILAB / PYTHON / OCTAVE	K3
C214.8	Design the sampling rate converter for the given specifications	K3

REFERENCES:

1. Emmanuel C. Ifeachor and Barrie W. Jervis, “Digital Signal Processing”, Pearson Education / Prentice Hall, 4th Edition, 2007.
2. A.V.Oppenheim, R.W.Schafer and J.R.Buck, “Discrete-Time Signal Processing”, Pearson, 8th Indian Reprint, 2004.
3. Vinay K. Ingle and John G. Proakis,”Digital Signal Processing using MATLAB”, 3rd Edition, Cengage Learning Custom Publication, 2011.
4. Andreas Antoniou, “Digital Signal Processing”, Tata McGraw-Hill, 2006.
5. Ramesh Babu, “Digital Signal Processing”, Scitech Publication, 6th Edition, 2014.

20EC4L1 ANALOG INTEGRATED CIRCUITS LABORATORY

L	T	P	C
0	0	3	1.5

OBJECTIVES:

- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function IC.
- To use SPICE software for circuit design.

PRE-REQUISITE: NIL

LIST OF ANALOG EXPERIMENTS

1. Inverting Amplifier, Non-Inverting Amplifier and Differential amplifier.
2. Integrator and Differentiator.
3. Active – Low pass filter, High Pass filter.
4. Active Band pass filter.
5. Phase shift oscillator and Wein bridge oscillator using Op-amp.
6. Astable multivibrator and Monostable multivibrator using op-amp IC 741.
7. Schmitt trigger using op-amp IC 741.
8. Astable and Monostable multivibrator using NE555 timer.
9. DC power supply using LM 317 and LM 723.
10. PLL use as frequency multiplier.
11. R-2R ladder type D-A converter using op-amp.

SIMULATION USING SPICE

12. Simulation of Active low pass filter, High Pass filter and Band pass filter using Op-Amp.
13. Simulation of Astable and Monostable multivibrator using NE555 timer and IC 741.

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:

1) CRO/DSO – 15 Nos.
2) Signal Generator / Function Generators – 15 Nos.
3) Dual Regulated Power Supplies – 15 Nos.
4) Digital Multimeter – 15 Nos.
5) IC Tester – 5 Nos.
6) Desktop PC – 15 Nos.
7) SPICE Circuit Simulation Software: (any public domain or commercial software)
8) Components and Accessories: Resistors, Capacitors, Diodes, Bread Boards.

Note: Op-Amps uA741, LM317, LM723, NE555, NE565 may be used.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Analog Integrated Circuits Laboratory		**Course Code :** 20EC4L1
CO	**Course Outcomes**	**K-CO**
C215.1	Construct integrator, differentiator and amplifier using Op-amp 741.	K3
C215.2	Analyze the applications of an Op-amp: Filters and Oscillators.	K4
C215.3	Build multivibrators using special application IC555 and general purpose Op-amp	K3
C215.4	Construct digital to analog converter.	K3
C215.5	Demonstrate the function of application specific ICs such as voltage regulators LM317 and LM723, applications of PLL in communication	K3
C215.6	Simulate the Op-amp applications using SPICE	K4

20HS4L1	PROFESSIONAL COMMUNICATION AND TECHNICAL PRESENTATION	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To impart the practical approach in learning and enhancing communication skill among engineering students.
- To identify appropriate expressions in speaking and writing.
- To understand the style and perfection of language in reading and listening various contexts of engineering and technology.
- To gain confidence for everyday communication, technical presentation, aptitude test and interviews.

UNIT - I Listening **6**

Listen and takes notes of Lecture, Talks on Engineering and Technology, Developing effective listening skills, barriers to effective listening, Listening self-Introduction Videos

UNIT - II Speaking **6**

Self-Introduction, Introduce oneself to the audience, Sharing memorable incidents, Individual presentation practice, Introduction to Group Discussion, GD strategies - activities to improve GD skills

UNIT - III Reading **6**

Reading Online Blogs, Reading Advertisement in Online, Newspaper archives reading, Reading FAQ's related to job Interview, General awareness of current affairs

UNIT - IV Writing **6**

Process Description, Narrating experiences, Creating Email blogs, Review Writing – Books, Movies, and Journals, Job Application Letter, Resume Writing

UNIT - V Summarized Activities **6**

Reading: Cloze exercises, Identifying redundant words, Jargon words, Foreign words, Technical terms

Writing: Error free sentences, Essay writing on various levels – basic, middle, and advanced, Preparing Job application letter and Resume

Speaking: Face to face conversation on specific topics, Answering Interview Questions, Panel Interview, Participating in Group Discussions, Technical Presentation

TECHNICAL PRESENTATION **15**

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Professional Communication And Technical Presentation		**Course Code :** 20EC4L1
CO	**Course Outcomes**	**K-CO**
C216.1	Listen and Respond global English appropriately	K3
C216.2	Participate in group discussions towards placement drive	K4
C216.3	Communicate with effective technological skills	K3
C216.4	Read and Write the context cohesively and coherently and organize ideas logically in workplace situations	K3
C216.5	Attend job interviews and be successful in them	K3
C216.6	Make effective presentations of technical topics	K3

TEXT BOOKS:

1. E.Suresh Kumar, B.Sandhya, J.Savithri andP.Sreehari, “Communication for Professional Success”, Orient Blackswan Private Limited, New Delhi, 2013.

REFERENCES:

1. Jeff Butterfield, “Soft Skills of Everyone”, Cengage Learning, 1st Edition, 2011.
2. OBS Exports, “Interact English Lab Manual for Undergraduate Students”, Orient BlackSwan, 2018.
3. Meenakshi Raman and Sangeetha Sharma, “Professional Communication”, Oxford University Press, 2018.
4. S.Hariharan, N.Sundararajan and S.P.Shanmuga Priya, “Soft Skills”, MJP Publishers, 2013.

20EC508	CONTROL SYSTEM ENGINEERING	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To introduce the components and their representation of control systems.
- To study various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approach for the state variable analysis.

PRE-REQUISITE:

Course Code: 20BS201
Course Name: Laplace Transform and Advanced Calculus

UNIT - I CONTROL SYSTEM MODELING **12**

Basic Elements of Control System - Open loop and Closed loop systems - Differential equation - Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems -Block diagram reduction Techniques - Signal flow graph

UNIT - II TIME RESPONSE ANALYSIS **12**

Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors - P, PI, PD and PID Compensation, Analysis using MATLAB

UNIT - III FREQUENCY RESPONSE ANALYSIS **12**

Frequency Response - Bode Plot, Polar Plot - Frequency Domain specifications from the plots - Constant M and N Circles. Series, Parallel, series-parallel Compensators - Lead, Lag, and Lead Lag Compensators, Analysis using MATLAB

UNIT - IV STABILITY ANALYSIS **12**

Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion - Relative Stability

UNIT - V STATE VARIABLE ANALYSIS **12**

State space representation of Continuous Time systems - State equations - Transfer function from State Variable Representation - Solutions of the state equations - Concepts of Controllability and Observability - State space representation for Discrete time systems

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Control System Engineering		**Course Code :** 20EC508
CO	**Course Outcomes**	**K-CO**
C301.1	Develop a transfer function for a given electrical and mechanical system and derive the transfer function using block diagram reduction and signal flow graph.	K3
C301.2	Derive the transient and steady state response of first and second order control systems for standard input signals.	K3
C301.3	Determine the frequency response parameters for the given open loop system using Bode and Polar plots.	K3
C301.4	Analyze the stability of a system using Routh Hurwitz, Root locus and Nyquist criterion.	K4
C301.5	Develop a state space model for a given electrical and mechanical system.	K3
C301.6	Analyze the stability of the system using controllability and observability.	K4

TEXT BOOKS:

1. J.Nagrath and M.Gopal, “Control System Engineering”, New Age International Publishers, Fifth Edition, 2017.
2. Norman S. Nise, “Control Systems Engineering”, Wiley, 2018.

REFERENCES:

1. Benjamin C. Kuo, “Automatic control systems”, McGraw Hill Education, 2018.
2. Schaum’s Outline Series, “Feedback and Control Systems”, McGraw Hill Education, 2017.
3. Richard C. Dorf and Robert H. Bishop, “Modern Control Systems”, Pearson Education India, 2013.

20EC509	TRANSMISSION LINES AND WAVE GUIDES	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To introduce the basic theory of transmission lines
- To understand the concept of high frequency line
- To introduce power, impedance, VSWR and Wavelength measurements
- To impart technical knowledge in impedance matching using smith chart
- To introduce waves between parallel planes and rectangular waveguide
- To introduce circular waveguide and resonators

PRE-REQUISITE:

Course Code: 20EC403
Course Name: Electromagnetic Fields

UNIT - I TRANSMISSION LINE THEORY **12**

General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion-less line - Loading and different methods of loading - Line not terminated in characteristic Impedance - Reflection coefficient - Input and transfer impedance - Open and short-circuited lines - reflection factor and reflection loss.

UNIT - II HIGH FREQUENCY TRANSMISSION LINES **12**

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation-less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation-less line - Open and short-circuited lines - Power and impedance measurement on lines - Measurement of VSWR and wavelength- power in dB, dBm, dBmw.

UNIT - III IMPEDANCE MATCHING IN HIGH FREQUENCY LINES **12**

Impedance matching: Quarter wave transformer - Impedance matching by stubs - Single stub and double stub matching - Smith chart properties and its applications - Solutions of problems using Smith chart - Single and double stub matching using Smith chart.

UNIT - IV GUIDED WAVES BETWEEN PARALLEL PLANES AND RECTANGULAR WAVE GUIDE **12**

Waves between parallel planes of perfect conductors - Transverse electric and transverse magnetic waves - characteristics of TE and TM Waves - Transverse Electromagnetic waves. Transverse Magnetic Waves in Rectangular Wave guides - Transverse Electric Waves in Rectangular Waveguides - characteristic of TE and TM Waves - Cutoff wavelength - Impossibility of TEM waves - Dominant mode in rectangular waveguide.

UNIT - V CIRCULAR WAVE GUIDES AND RESONATORS **12**

Field equations - TM and TE waves in circular guides - wave impedances - Dominant mode in circular waveguide - excitation of modes - TEM wave in coaxial lines - Microwave cavities - Rectangular cavity resonators - circular cavity resonator.

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Transmission Lines and Wave Guides		**Course Code :** 20EC509
CO	**Course Outcomes**	**K-CO**
C302.1	Explain the characteristics of transmission lines and its losses.	K2
C302.2	Derive the standing wave ratio and input impedance in high frequency transmission lines.	K3
C302.3	Classify various types of measurements in high frequency lines.	K3
C302.4	Analyze impedance matching by stubs using smith charts.	K4
C302.5	Analyze TE, TM waves between parallel planes and rectangular waveguide, characteristics of TE, TM waves.	K4
C302.6	Derive the characteristics of TE and TM waves in circular waveguide.	K3

TEXT BOOKS:

1. John D. Ryder, "Networks, lines and fields", Pearson Education India, Second Edition, 2015.
2. E.C. Jordan and K.G. Balmain, “Electromagnetic Waves and Radiating Systems”, Pearson Indian Edition, Second Edition, 2015.

REFERENCES:

1. Ramo, Whineery and Van Duzer, “Fields and Waves in Communication Electronics”, John Wiley, 2003.
2. David K. Cheng, “Field and Waves in Electromagnetism”, Pearson Edition, 1989.
3. G.S.N. Raju, “Electromagnetic Field Theory and Transmission Lines”, Pearson Edition, 2006.

20EC510	ANALOG AND DIGITAL COMMUNICATION TECHNIQUES	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To introduce the concepts of various analog modulations and their spectral characteristics.
- To know the effect of noise on communication systems.
- To study the various waveform coding schemes.
- To understand the various band pass signaling schemes.
- To know the fundamentals of channel coding.

PRE-REQUISITE:

Course Code: 20EC302
Course Name: Signals and Systems

UNIT - I ANALOG COMMUNICATION SYSTEMS 12

Amplitude Modulation, envelope detection, Double Side Band Suppressed Carrier Modulation, Single side band Modulation, Vestigial Side band Modulation, Angle Modulation Systems: Narrow band and wideband FM, Generation and demodulation of FM waves, Phase Modulation, Noise Analysis.

UNIT - II ANALOG TO DIGITAL TRANSITION SYSTEMS 12

Pulse Amplitude Modulation, Sample and Hold -Pulse Position Modulation-Quantization process -Pulse Code Modulation, DPCM, Delta Modulation- Quantization error.

UNIT - III BASEBAND PULSE TRANSMISSION 12

Inter Symbol Interference problem, Baseband Transmission of Digital Data-Nyquist criterion, Raised cosine pulse, Transmission Bandwidth Requirement - Eye Pattern.

UNIT - IV PASSBAND TRANSMISSION 12

Gram-Schmidt Orthogonalization Procedure, Detection of known signals in noise, Correlation receiver, Matched Filter receiver, Binary Amplitude Shift Keying, Binary Phase Shift Keying, Binary Frequency Shift Keying, QAM**,** BER Analysis.

UNIT - V ERROR CONTROL CODING 12

Channel coding theorem, Linear block codes, Repetition Codes, Syndrome Decoding, Hamming Codes-Cyclic codes- Calculation of Syndrome -Convolutional codes, Code Tree, Trellis state diagram, Viterbi Decoder.

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Analog and Digital Communication Techniques		**Course Code :** 20EC510
CO	**Course Outcomes**	**K-CO**
C303.1	Analyze the different analog modulation schemes in time and frequency domain.	K4
C303.2	Compute the output Signal to Noise ratio of analog modulation schemes in the presence of additive white Gaussian noise.	K3
C303.3	Illustrate the principles of pulse modulation techniques and waveform coding techniques.	K3
C303.4	Apply the base band pulse for ISI free transmission over finite bandwidth channels.	K3
C303.5	Apply the estimation and detection techniques in the design of various digital modulation systems for the analysis of Bit error rate performance.	K3
C303.6	Apply the given error control coding techniques to detect and correct the errors present in the communication channel.	K3

TEXT BOOKS:

1. Simon Haykin and Michael Moher, “An Introduction to Analog and Digital Communications”, John Wiley & Sons, Second Edition, 2012.
2. Simon Haykin, “Digital Communication Systems”, John Wiley& Sons Inc., 2014.

REFERENCES:

1. Simon Haykin and Michael Moher, “Communication systems” John Wiley & Sons, Fifth Edition, 2016.
2. Leon W. Couch, “Digital and Analog Communication Systems”, Prentice Hall, 1997.
3. Sam Shanmugam, “Digital and Analog Communication Systems”, John Wiley, Second Edition, 1992.
4. B.Carlson, “Introduction to Communication systems”, McGraw Hill, Third Edition, 1989.

20EC511	MICROPROCESSOR AND MICROCONTROLLER BASED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the architecture of 8086 microprocessor.
- To learn the architecture of 8051 microcontroller.
- To learn the programming of internal peripherals of 8051 microcontroller.
- To learn the architecture of ARM microcontroller.
- To study different interfacing device with ARM microcontroller.

PRE-REQUISITE:

Course Code: 20EC303
Course Name: Digital System Design

UNIT - I THE 8086 MICROPROCESSOR 9

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation

UNIT - II 8051 MICROCONTROLLER AND PROGRAMMING 9

Introduction to Microcontrollers - Architecture of 8051 - Registers - Pin Description- Connections - Input and Output Ports - Memory Organization - Instruction set - Addressing Modes - Assembly language programming.

UNIT - III INTERNAL – PERIPHERALS OF 8051 MICROCONTROLLER 9

GPIO architecture – Timer architecture and modes of operation – Timer programming – UART and modes of operation – UART programming by polling and interrupt driven – Timer and UART programming in C.

UNIT - IV ARM ARCHITECTURE 9

Architecture – memory organization – addressing modes – The ARM Programmer's model – Registers – Pipeline – Interrupts – Coprocessors – Interrupt Structure – ARM general Instruction set – Thumb instruction set.

UNIT - V PERIPHERALS OF ARM MICROCONTROLLER 9

ARM: I/O Memory – EEPROM – I/O Ports – Timer – UART – ADC/DAC Interfacing – Serial bus communication protocols – RS232 standard – USB – CAN bus.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Microprocessor And Microcontroller Based Systems		**Course Code :** 20EC511
CO	**Course Outcomes**	**K-CO**
C304.1	Develop the assembly language programs for 8086 microprocessor.	K3
C304.2	Develop embedded C programs for 8051 microcontroller.	K3
C304.3	Discuss the 8051 microcontroller interfacing devices.	K3
C304.4	Explain the architecture of ARM processor.	K2
C304.5	Discuss the ARM microcontroller interfacing devices.	K2
C304.6	Discuss the ARM microcontroller interfacing devices.	K2

TEXT BOOKS

1. Yu-Cheng Liu and Glenn A. Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi and Rolin Mc Kinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011.

REFERENCES:

1. Rajkamal, “Embedded system - Architecture, Programming, Design”, TMH, 2011.
2. Marilyn Wolf, “Computers as Components - Principles of Embedded Computing System Design”, Third Edition, Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
3. Doughlas V. Hall, “Microprocessors and Interfacing, Programming and Hardware”, TMH, 2012.
4. M.Senthilkumar, M.Saravanan and S.Jeevananthan, “Microprocessors and Microcontrollers”, Oxford University Press, 2013.
5. Lyla B. Das, “Embedded Systems: An Integrated Approach”, Pearson Education, 2013.
6. Steve Furber, “ARM system on chip architecture”, Addision Wesley, 2010.
7. Trevor Martin, “The Insider’s guide to the Philips ARM7-based Microcontrollers”, Hitex (UK) Ltd., 2005.

20MC501 CONSTITUTION OF INDIA

L	T	P	C
1	0	0	0

OBJECTIVES:

- To enable the student to understand the importance of the constitution.
- To understand the structure of executive, legislature, and judiciary.
- To understand the philosophy of fundamental rights, duties and emergency provisions.
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court.
- To understand the central and state relation financial and administrative.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION 3

History of Making of the Indian Constitution - Drafting Committee - (Composition & Working) - Philosophy of the Indian Constitution – Preamble - Salient Features.

UNIT - II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES 3

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 - III ORGANS OF GOVERNANCE 3

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 - IV EMERGENCY PROVISIONS 3

Emergency Provisions - National Emergency, President Rule, Financial Emergency.

UNIT - V LOCAL ADMINISTRATION 3

District's Administration head - Role and Importance. Municipalities – Introduction - Mayor and role of Elected Representative - CEO of Municipal Corporation. Pachayati raj – Introduction – PRI - Zila Pachayat 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.

TOTAL: 15 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Constitution of India		**Course Code :** 20MC501
CO	**Course Outcomes**	**K-CO**
C305.1	Explain history and philosophy of Indian constitution.	K2
C305.2	Explain the premises informing the twin themes of liberty and freedom from a civil rights perspective.	K2
C305.3	Explain the powers and functions of Indian government.	K2
C305.4	Explain the emergency rules of Indian constitution.	K2
C305.5	Explain the structure and functions of local administration.	K2

TEXT BOOKS:

1. Rajesh Kumar, “Universal’s Guide to the Constitution of India”, Universal Law Publications, 2016.
2. D.C. Gupta, “Indian Government and Politics”, Vikas Pub, 2018.

REFERENCES:

1. H.M. Sreevai, “Constitutional Law of India”, Universal Law Publication, Fourth Edition in 3 Volumes.
2. J.C. Johari, “Indian Government and Politics”, Shoban Lal & Co, 2012.
3. A.G. Noorani, “Challenges to Civil Rights Guarantees in India”, South Asia Human Rights Documentation Centre, Oxford University Press, 2012.

20EC505	DIGITAL VLSI DESIGN AND FPGA IMPLEMENTATION	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To describe the integrated circuit design process and VLSI circuit design techniques.
- To learn the MOS transistor theory, CMOS processing technology, VLSI design methodologies and various CMOS circuit design techniques.
- Integrated digital systems are designed and simulated throughout the course using VLSI design tools.
- To understand and experience the conventional VLSI design flow, and gain sufficient background for more advanced courses in the field.

PRE-REQUISITE:

Course Code: 20EC201, 20EC303, 20EC402, 20EC404
Course Name: Network Analysis, Digital System Design, Computer Architecture and Organization, Analog Electronics and Integrated Circuits

UNIT - I INTRODUCTION TO MOS TRANSISTOR **9**

Basic MOS Transistors - IC production process - MOS and CMOS Fabrication processes - PVT Characteristics - Pass Transistor Logic - CMOS Inverter - I-V Characteristics - DC Transfer characteristics - RC Delay Model - Elmore Delay - Logical effort - Scaling - Layout Design Rules.

LAB COMPONENT

1. Design and simulate a CMOS inverter.
2. Design and simulate a CMOS AND gate.

(Pre-Layout and Post-Layout Analysis, Synthesis, Simulation and Layout generation) **6**

UNIT - II SEQUENTIAL CIRCUIT DESIGN **9**

Static latches and Registers - The bistability principle - Multiplexer based latches - Master-slave edge triggered register - Dynamic latches and Registers - Dynamic transmission gate edge triggered register - Clocked CMOS - True single-phase clocked register - Pipelining - Schmitt Trigger - Monostable Sequential Circuits - Astable Sequential Circuits.

LAB COMPONENT

3. Design and simulate a CMOS OR gate.
4. Design and simulate CMOS Flip Flops.

(Pre-Layout and Post-Layout Analysis, Synthesis, Simulation and Layout generation) **6**

UNIT - III DESIGN OF ARITHMETIC BUILDING BLOCKS **9**

Data Paths - Adders - Ripple carry adder - Static adder circuit - Manchester carry chain adder - Carry Bypass adder - Carry select adder - Carry look ahead adder - Multipliers - partial product generation - Modified Booth recoding - Partial product accumulation - Array multiplier - Carry save multiplier - Wallace tree multiplier - Shifters - ALUs.

LAB COMPONENT

5. Design and Testing of an Adder.
6. Design and Testing of a Multiplier.
7. Design and Testing of an ALU

(Simulation, Synthesis and Implementation using FPGA design flow) **6**

UNIT - IV MEMORY DESIGN 9

Timing Classification of Digital System - Dynamic Power - Static Power - Issues in Low Power Architecture - Memory classification - Memory architecture and building blocks - Memory core - ROM cells - An overview - EPROM - EEPROM - Read-Write Memories - Static Random-Access Memory - Dynamic Random-Access Memory.

LAB COMPONENT

8. Design and Testing of a Universal Shift Register.
9. Design and Testing of a Finite State Machine (Moore/Mealy). **6**

(Simulation, Synthesis and Implementation using FPGA design flow)

UNIT - V FPGA IMPLEMENTATION 9

FPGA Building Block Architectures - Configurable Logic Blocks - LUT based structures - FPGA Interconnect Routing Procedures - Digital clock Managers - Block RAM - Distributed RAM. Case Study: Xilinx Zynq SoC Architecture.

LAB COMPONENT

10. Design and Testing of Memories - RAM
11. Design and Testing of a Memories - ROM **6**

(Simulation, Synthesis and Implementation using FPGA design flow)

TOTAL: 75 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Digital VLSI Design and FPGA Implementation		**Course Code :** 20EC505
CO	**Course Outcomes**	**K-CO**
C306.1	Discuss the detailed analysis of the static CMOS inverter and illustrate complementary designs in addition to variants such as pseudo-nMOS circuits and novel XOR/XNOR networks	K2
C306.2	Make use of Lambda based design rules to express the layout of simple MOS circuit	K3
C306.3	Construct the sequential circuits using CMOS transistors	K3
C306.4	Design arithmetic circuits like Adders, Multipliers, Shifter and ALU by using different methods	K3
C306.5	Derive the power dissipation in memory architectures and discuss the challenges in the low power VLSI architecture	K3
C306.6	Explain the basic principles and methods of FPGA and different types of design for testability in VLSI.	K2
C306.7	Demonstrate CMOS inverter, basic gates and flip-flops by using a suitable EDA tool and obtain its Layout Generation and Post Layout Extraction.	K3
C306.8	Demonstrate Memories, arithmetic circuits like Adders, Multipliers, Shifter and ALU and sequential circuits like Universal Shift register, Finite State Machine in an Integrated Synthesis Environment and test the design by reprogramming FPGA.	K3

TEXT BOOKS:

1) Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, “Digital Integrated Circuits: A Design perspective”, Pearson, Second Edition, 2016.
2) Neil H.E. Weste and David Money Harris, “CMOS VLSI Design: A Circuits and Systems Perspective”, Pearson, Fourth Edition, 2017.

REFERENCES:

1) Scott Hauck, André DeHon, “Reconfigurable computing: the theory and practice of FPGA-based computation”, Morgan Kaufmann, 2007.
2) Vaibbhav Taraate, “ASIC Design and Synthesis”, Springer, 2021.
3) Jean-Pierre Deschamps, GéRy Jean Antoine Bioul and Gustavo D. Sutter, “Synthesis of Arithmetic Circuits”, A John Wiley & Sons, Inc., Publication, 2006.
4) Khosrow Golshan, “Physical Design Essentials”, Springer, 2007.
5) Stuart Sutherland, “RTL Modeling with System Verilog for Simulation and Synthesis”, Sutherland HDL, Inc., 2017.

20EC5L1 COMMUNICATION SYSTEMS LABORATORY

L	T	P	C
0	0	3	1.5

OBJECTIVES:

- To visualize the effects of sampling and TDM
- To implement AM & FM modulation and demodulation
- To implement PCM & DM
- To simulate digital modulation schemes
- To simulate error control coding schemes

LIST OF EXPERIMENTS:

1. Signal Sampling and reconstruction
2. Time Division Multiplexing
3. AM Modulator and Demodulator
4. FM Modulator and Demodulator
5. Pulse Code Modulation and Demodulation
6. Delta Modulation and Demodulation
7. Line coding schemes
8. Simulation of ASK and PSK generation, detection schemes
9. Simulation of signal constellations of BPSK, QPSK and QAM
10. Simulation of BFSK generation and detection scheme
11. Simulation of Linear Block and Cyclic error control coding schemes
12. Simulation of Convolutional coding scheme

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:

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

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Communication Systems Laboratory		**Course Code :** 20EC5L1
CO	**Course Outcomes**	**K-CO**
C307.1	Construct sampling and reconstruction circuit of analog signal to implement Time Division Multiplexing.	K3
C307.2	Design and Implement Analog modulation schemes.	K3
C307.3	Demonstrate various Pulse modulation schemes.	K3
C307.4	Analyze various channel coding schemes & demonstrate their capabilities towards the improvement of the noise performance of communication system.	K3
C307.5	Validate a digital modulation system.	K3
C307.6	Simulate signal constellations of BPSK and QPSK.	K3

20EC5L4	MICROPROCESSOR AND MICROCONTROLLER BASED SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To write ALP for arithmetic and logical operations in 8086
- To write ALP for arithmetic and logical operations in 8051
- To write programs to interface I/Os with 8051.
- To write programs to interface I/Os with ARM processor.

LIST OF EXPERIMENTS:

8086 Programs using kits and MASM

1. Basic arithmetic and Logical operations.
2. String manipulations.

8051 Programs using Kits and MASM

3. Basic arithmetic and Logical operations.
4. Square and Cube program, factorial of a number.
5. Stepper motor interface.
6. Traffic light interface.

Programming using ARM Processor:
LPC 2148 (ARM7)

7. Interfacing ADC and DAC.
8. Interfacing LED and PWM.
9. Interfacing real time clock and serial port.
10. Interfacing keypad and LCD.
11. Interfacing Wi-Fi

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS:

1. PCs with MASM, Keil, any equivalent software - 15 Nos.
2. 8051 Trainer Kits - 10 Nos.
3. 8086 Trainer Kits - 10 Nos.
4. ARM LPC 2148 Kits - 10 Nos.
5. Interfacing Units for 8051 - 15 Nos.
6. Interfacing Units for ARM - 10 Nos.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Microprocessors and Microcontrollers Based System Laboratory		**Course Code :** 20EC5L4
CO	**Course Outcomes**	**K-CO**
C308.1	Develop ALP for Arithmetic and logical operations using 8086.	K3
C308.2	Develop ALP for Arithmetic and logical operations using 8051.	K3
C308.3	Construct the Interface for stepper motor and traffic light with 8051 microcontroller.	K3
C308.4	Construct the Interface for ADC and DAC with ARM microcontroller.	K3
C308.5	Construct the Interface LED, PWM, real time clock and serial port with ARM.	K3
C308.6	Develop programs for interfacing keypad and LCD with ARM.	K3

20EC604	MODERN ANTENNAS IN WIRELESS TELECOMMUNICATIONS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To give insight of the radiation phenomena and antenna fundamentals.
- To give a thorough understanding of radiation characteristics of different types of antenna arrays.
- To analyze the antenna characteristics and working principles of various types of apertures and wireless antenna.
- To be aware of various types of antenna measurement methods.
- To create awareness about the radio wave propagation in the atmosphere.

PRE-REQUISITE:

Course Code: 20EC509
Course Name: Transmission lines and wave guides

UNIT - I ANTENNA FUNDAMENTALS 12

Definition of antenna - Need of an antenna - Antenna parameters: Gain, Directivity, Effective aperture, Radiation Resistance, Radiation pattern, Band width, Beam width, Input Impedance - retarded vector potential - Dipole and mono pole - Power radiated and radiation resistance (Rr) of a half wave dipole.

UNIT - II ANTENNA ARRAYS 12

Definition of antenna array - Need of an antenna array - Pattern multiplication - Broad side array - End fire array - collinear array - Binomial array - Array of 2-point sources with equal amplitude and equal phase - Equal amplitude and opposite phase.

UNIT - III APERTURE ANTENNAS (Quantitative Analysis only) AND ANTENNA MEASUREMENT 12

Babinet principle - Huygens's principle - Yagi Uda Antenna - Log periodic Dipole Array - Helical Antenna - Slot antenna - Horn Antenna: types and application - Reflector Antenna - Aperture blockage - Feeding structures. Antenna measurement technique: Gain, Radiation pattern, VSWR, Polarization.

UNIT - IV ANTENNAS FOR WIRELESS APPLICATIONS 12

Patch antenna: radiation mechanism, characteristics and application - Antennas for handheld devices -smart antenna array - MIMO antennas, Choice of antennas for 5G and beyond. Antennas for mobile communication systems: Base station antennas, mobile station antennas. Reconfigurable antenna.

UNIT - V PROPAGATION OF RADIO WAVES 12

Modes of propagation - Structure of atmosphere - Ground wave propagation - Tropospheric propagation - Duct propagation - Troposcatter propagation - Flat earth and Curved earth concept - Sky wave propagation - Virtual height - Critical frequency - Maximum usable frequency - Skip distance - Fading - Multi hop propagation.

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Modern Antennas in Wireless Telecommunications		**Course Code :** 20EC604
CO	**Course Outcomes**	**K-CO**
C309.1	Explain the behavior of antenna in terms of its parameter	K2
C309.2	Assess the need for antenna arrays and mathematically analyze the types of antenna arrays	K3
C309.3	Classify Microwave and sub microwave antennas.	K3
C309.4	Illustrate various antenna measurement techniques.	K3
C309.5	Analyze different types of antennas for wireless applications	K4
C309.6	Identify various factors involved in the propagation of radio waves	K3

TEXT BOOKS:

1. John D. Kraus, Ronald J. Marhefka and Ahamed S. Khan, “Antennas and wave propagation”, Mc Graw Hill Education (India) Private limited, Fifth Edition, 2018.
2. S. Drabowitch, “Modern Antennas”, Springer Publications, Second Edition, 2010.

REFERENCES:

1. Edward C. Jordan and Keith G.Balmain, “Electromagnetic Waves and Radiating Systems”, Pearson Education, Second Edition, 2015.
2. R.E. Collin, “Antennas and Radiowave Propagation”, Mc Graw Hill, Fourth Edition, 1985.
3. Constantine A. Balanis, “Antenna Theory: Analysis and Design”, Wiley Publication, Fourth Edition, 2016.
4. H.Sizun,“Radio Wave Propagation for Telecommunication Applications”, Springer Publications, First Indian Reprint, 2007.
5. K.D. Prasad, “Antennas and Wave Propagation”, Sathya Prakashan, 2009.

20EC602	COMMUNICATION NETWORKS	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To understand the division of network functionalities into layers.
- To be familiar with the components required to build different types of networks.
- To be exposed to the required functionality at each layer.
- To learn the flow control and congestion control algorithms.

PRE-REQUISITE: NIL

UNIT - I FUNDAMENTALS OF COMPUTER NETWORKS & LINK LAYER **9**

Overview of Data Communications - Networks - Building Network and its types - Overview of Internet - Protocol Layering - OSI Mode - Physical Layer - Overview of Data and Signals - introduction to Data Link Layer - Link layer Addressing - Error Detection and Correction.

LAB COMPONENT

1. Implementation of Error Detection / Error Correction Techniques.
2. Write a socket program for Echo/Ping/Talk commands. **6**

UNIT - II MEDIA ACCESS & INTERNETWORKING **9**

Overview of Data link control and Media access control - Ethernet (802.3) - Wireless LANs - Available Protocols - Bluetooth - WiFi - Zigbee - Network layer services - Packet switching - IPv4 address - Network layer protocols (IP, ICMP, Mobile IP).

LAB COMPONENT

3. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
4. Implementation of stop and wait protocol and sliding window protocol. **6**
5. Implementation of Bit and Byte Stuffing.

UNIT - III NETWORK LAYER **9**

Routing - Unicast Routing - Algorithms - Protocols - Multicast Routing and its basics - Overview of Intra-domain and inter-domain protocols - Overview of IPv6 addressing - Transition from IPv4 to IPv6.

LAB COMPONENT

6. Implementation of distance vector routing algorithm.
7. Implementation of Link State Routing algorithm. **6**

UNIT - IV TRANSPORT LAYER **9**

Introduction to Transport layer – Protocols - User Datagram Protocols (UDP) and Transmission Control Protocols (TCP) - Services - Features - TCP Connection - State Transition Diagram - Flow, Error and Congestion Control - Congestion avoidance (DEC bit, RED) - QoS - Application requirements.

LAB COMPONENT

8. Implementation and study of Go back-N and selective repeat protocols.
9. Study of Socket Programming and Client - Server model. **6**

UNIT - V APPLICATION LAYER **9**

Application Layer Paradigms - Client Server Programming - World Wide Web and HTTP - DNS - Electronic Mail (SMTP, POP3, IMAP, MIME) - Introduction to Peer-to-Peer Networks - Need for Cryptography and Network Security - Layers of Network Security - Firewalls.

LAB COMPONENT

10. Encryption and decryption.
11. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS. **6**

TOTAL: 75 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Communication Networks		**Course Code :** 20EC602
CO	**Course Outcomes**	**K-CO**
C310.1	Identify the components required to build different types of networks.	K3
C310.2	Identify solution required functionality at data link layer.	K3
C310.3	Analyse the routing path of network.	K4
C310.4	Construct routing and forwarding solutions for packet switching networks.	K3
C310.5	Choose the required functionality at Transport layer for a given application	K3
C310.6	Classify the protocols in the Application Layer.	K3
C310.7	Develop C/Java/python Programming to implement the cryptographic techniques and error control algorithms.	K3
C310.8	Develop C/Java/python Programming to implement routing and flow control algorithms.	K3

TEXT BOOKS:

1. Behrouz A. Forouzan, “Data communications and Networking”, McGraw Hill Education, Fifth Edition, 2017.
2. Larry L. Peterson and Bruce S. Davie, “Computer Networks: A Systems Approach”, Morgan Kaufmann Publishers, Fifth Edition, 2011.

REFERENCES:

1. James F. Kurose and Keith W. Ross, “Computer Networking: A Top-Down Approach Featuring the Internet”, Pearson Education, Seventh Edition, 2016.
2. Nader. F. Mir, “Computer and Communication Networks”, Pearson Prentice Hall Publishers, Second Edition, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, “Computer Networks: An Open Source Approach”, Mc Graw Hill Publisher, 2011.

20EC6L1 **MINI PROJECT** **L T P C**
0 0 4 2

OBJECTIVES:

- To allow the students to explore the breadth of research that is being performed within the college.
- To implement electronic hardware by learning PCB artwork design, soldering techniques, testing, and troubleshooting, etc.
- To set the students apply the programming knowledge into a real world situation/problem.
- To work as an individual or in a team in development of technical projects.
- To communicate and report effectively project related activities and findings.

PRE-REQUISITE: NIL

Course Contents:

Mini project may be carried out in one or more form of following:
Product preparations, working/non-working models, prototype development, fabrication of set-ups, laboratory experiment development, process modification/development, simulation, software development, integration of software and hardware, statistical data analysis, survey, creating awareness in society.
The student is required to submit a report based on the work. The evaluation of the project shall be on continuous basis.

OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Mini Project		**Course Code :** 20EC6L1
CO	**Course Outcomes**	**K-CO**
C311.1	Analyze real-world engineering problems to clearly meet the technical requirements, practical constraints, and functional specifications needed to design a prototype model.	K3
C311.2	Explore and compare different hardware options, software tools, and design strategies to choose the most suitable solution approach.	K3
C311.3	Evaluate multiple design alternatives to justify the chosen system architecture using engineering principles.	K2
C311.4	Test the developed system in a systematic way to assess its accuracy, reliability, and efficiency using proper measurement and validation techniques.	K3
C311.5	Design and build a complete working prototype by effectively integrating hardware modules, software algorithms, and interface components to solve the identified problem.	K3
C311.6	Prepare thorough project documentation and present the final prototype with clear technical explanations, performance evidence, and alignment to professional engineering standards.	K2

20EC705 MICROWAVE AND OPTICAL COMMUNICATIONS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To deal with the microwave generation techniques.
- To inculcate understanding of the microwave network theory.
- To instill knowledge on the properties of various microwave components.
- To inculcate understanding of the basics required for optical fibers communication.
- To deal with the optical sources and detectors.

PRE-REQUISITE:

Course Code: 20EC502
Course Name: Transmission lines and wave guides

UNIT - I MICROWAVE GENERATION 12

Limitations of conventional Tubes – Klystron: working of Klystron, velocity modulation process and it's derivation, efficiency. Reflex Klystron: working, velocity modulation process, efficiency. Magnetron: working, Hull's cutoff voltage equation, mode jumping, frequency pushing and pulling. TWT: similarities and differences with klystron, working of TWT, Backward wave oscillator.

UNIT - II HIGH FREQUENCY NETWORK THEORY 12

Review of Low frequency parameters; Different types of interconnection of Two port networks, High Frequency parameters, Formulation of S parameters, Properties of S parameters, Reciprocal and lossless Network, Transmission matrix, RF behavior of Resistors, Capacitors and Inductors.

UNIT - III PASSIVE AND ACTIVE MICROWAVE DEVICES 12

Terminations, Attenuators, E-Plane Tee, H-Plane Tee, Magic Tee, Directional Coupler, S matrix for Directional Coupler, Non reciprocal devices: Circulator and Isolator. S matrix for Circulator and Isolator. PIN diode, Gunn Diode, IMPATT, TRAPATT diode.

UNIT - IV OPTICS AND OPTICAL FIBERS 12

Ray theory transmission – Total internal reflection – Acceptance angle – Numerical aperture – Skew rays – Step Index and Graded Index, Single Mode and Multi Mode fibers – Attenuation in a fiber, absorption, linear and non linear scattering losses – Dispersion, Intra model, intermodal dispersion - Fiber to Fiber Joints-Fiber Splicing-Optical Fiber connectors - Fiber in local loop.

UNIT - V OPTICAL SOURCES AND DETECTORS 12

Optical sources: Light Emitting Diodes – LED structures – surface and edge emitters, mono and hetero structures – internal quantum efficiency – injection laser diode structures – comparison of LED and ILD Optical Detectors: PIN Photo detectors, Avalanche photo diodes, construction – Comparison of performance – Photo detector noise – Signal to Noise ratio. Detector response time.

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Microwave and Optical Communications		**Course Code :** 20EC705
CO	**Course Outcomes**	**K-CO**
C401.1	Derive the mathematical parameters of various microwave sources.	K3
C401.2	Identify the high frequency parameters for Microwave network.	K3
C401.3	Explain the working principle of active microwave devices.	K2
C401.4	Compute S parameters for passive microwave devices.	K3
C401.5	Determine the basic parameters and characteristics of optical fiber.	K3
C401.6	Explain the working principle and characteristics of optical sources and detectors.	K2

TEXT BOOKS:

1. Annapurna Das and Sisir K. Das, “Microwave Engineering”, Mc Graw Hill India, Fourth Edition, 2020.
2. John M. Senior, “Optical Fiber Communication: Principles & Practice”, Pearson, Third Edition, 2009.

REFERENCES:

1. David M. Pozar, “Microwave Engineering”, Wiley India Pvt. Ltd., New Delhi, 2008.
2. Robert E, Colin, “Foundations for Microwave Engineering”, John Wiley & Sons Inc., 2005.
3. Gerd Keiser, “Optical Fiber Communication”, McGraw Hill International, Fourth Edition, 2010.
4. Samuel Y. Liao, “Microwave devices and Circuits”, Tata McGraw Hill Inc., 2004.
5. John Gowar, “Optical Communication Systems”, Prentice Hall India, 2001.
6. Govinda P. Agarwal, “Fiber-Optic Communication Systems”, John Wiley & Sons, Third Edition, 2004.
7. George Kennedy, Brendan Davis and Srm Prasanna, "Electronic Communication Systems", McGraw Hill Education, 5th Edition, 2011.

20EC702	WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the various cellular architectures.
- To know the characteristic of wireless channel.
- To understand the concepts behind various digital signaling schemes for fading channels.
- To familiar the various multipath mitigation techniques.
- To understand the various multiple antenna systems.

PRE-REQUISITE:
Course Code: 20EC503
Course Name: Analog and digital communication techniques

UNIT - I CELLULAR ARCHITECTURE 9

Evolution of wireless communication Standards from 2G to 5G -Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment - hand off - interference & system capacity- trunking & grade of service – Coverage and capacity improvement.

UNIT - II WIRELESS CHANNELS 9

Large scale path loss – Path loss models: Free Space and Two-Ray models - Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters-Coherence bandwidth – Doppler spread & Coherence time, Fading due to Multipath time delay spread – flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading.

UNIT - III DIGITAL SIGNALING FOR FADING CHANNELS 9

Structure of a wireless communication link, Principles of Offset - QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix, Windowing, PAPR – NOMA.

UNIT - IV MULTIPATH MITIGATION TECHNIQUES 9

Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macrodiversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.

UNIT - V MULTIPLE ANTENNA TECHNIQUES 9

MIMO systems – spatial multiplexing - System model - transmitter diversity, receiver diversity - Massive MIMO - Beamforming and MIMO – Cognitive radio - software defined radio - Communication relays - Spectrum sharing.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Wireless Communication		**Course Code :** 20EC702
CO	**Course Outcomes**	**K-CO**
C402.1	Apply the cellular concept to determine frequency reuse, cochannel interference	K3
C402.2	Derive the free space model and two ray model to characterize the wireless channels.	K3
C402.3	Determine the channel parameters for various fading channels.	K3
C402.4	Apply various signaling schemes for fading channels.	K3
C402.5	Apply equalization and diversity techniques to mitigate multipath fading.	K3
C402.6	Apply MIMO systems with transmitter and receiver diversity for fading channels.	K3

TEXT BOOKS:

1. Theodore S. Rappaport, “Wireless Communications: Principles and Practice”, Pearson Education, Second Edition, 2014.
2. Andreas F. Molisch, “Wireless Communications”, John Wiley India Pvt. Ltd., 2006.

REFERENCES:

1. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
2. Upena Dalal, “Wireless Communication”, Oxford University Press, 2009.
3. R.Van Nee and Ramji Prasad, “OFDM for wireless multimedia communications”, Artech House, 2000.
4. Aditya K. Jegannatham, “Principles of Modern Wireless Communication Systems”, Tata McGraw Hill, 2016.

20EC7L1	MICROWAVE AND OPTICAL COMMUNICATION LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Understand the working principle of optical sources, detector, fibers and microwave components.
- Develop understanding of simple optical communication link.
- Learn about the characteristics and measurements in optical fiber.
- Know about the behavior of microwave components.
- Practice simulation of wireless experiments.

PRE-REQUISITE:

Course Code: 20EC5L1

Course Name: Communication systems laboratory

LIST OF MICROWAVE EXPERIMENTS:

1. Mode characteristics of Reflex klystron.
2. Characteristics of Gunn diode.
3. Measurement of VSWR, frequency, wavelength.
4. Directional Coupler Characteristics.
5. Radiation Pattern and Gain of Horn Antenna.
6. E plane Tee, H Plane Tee, Magic Tee characteristics.
7. Characteristics of isolator and circulator.

LIST OF OPTICAL EXPERIMENTS:

8. Fiber optic Analog link and its band width.
9. Fiber optic digital Link.
10. Measurement of Attenuation and bending losses.
11. Numerical Aperture determination for Fibers.
12. DC Characteristics of LED.

TOTAL: 60 PERIODS

Note: Microwave test bench comprises of Reflex klystron or Gunn diode with power supply, Gunn oscillator, PIN modulator, Isolator, Fixed and Variable Attenuator, frequency meter, Slotted line section, Wave guides, detector with mount, Termination, Movable short, Slide screw tuner, Horn antenna, Directional coupler and 20 MHz Digital / Analog Oscilloscope.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS: (3 STUDENTS PER EXPERIMENT)

S.NO	NAME OF THE EQUIPMENT REQUIRED	Quantity
1.	Trainer kit for Carrying out characteristics of Analog link and Digital link.	2 Nos
2.	Trainer kit for determining the Attenuation & Bending loss in Optical fiber.	2 Nos
3.	Trainer kit for determining the Numerical aperture.	2 Nos
4.	Trainer kit for carrying out LED and Pin diode Characteristics.	2 Nos
5.	Microwave source with power supply (Klystron, Gunn Oscillator).	5 Nos
6.	Microwave passive components Circulator, Isolator, Directional Coupler, Slotted line Section, Horn Antenna, Tees, Movable short, Fixed and Variable Attenuator.	2 Nos
7.	Pin Modulator, Matched Termination, Diode Detector with Mount, Frequency Meter.	5 Nos
8.	Function Generator (3 MHz).	8 Nos
9.	CRO/DSO (20 MHz).	8 Nos

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Microwave and Optical Communication Laboratory		**Course Code :** 20EC7L1
CO	**Course Outcomes**	**K-CO**
C405.1	Demonstrate the characteristics of microwave generators.	K3
C405.2	Determine VSWR, frequency, wavelength and radiation pattern.	K3
C405.3	Experiment with microwave passive devices and obtain its characteristics.	K3
C405.4	Illustrate the characteristics of analog and digital optical fiber link.	K3
C405.5	Determine the losses and numerical aperture of the fiber.	K3
C405.6	Determine the characteristics of LED.	K3

20EC8L1	PROJECT WORK	L	T	P	C
		0	0	20	10

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.
- The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor.
- The progress of the project is evaluated based on a minimum of three reviews.
- The review committee may be constituted by the Head of the Department.
- A project report is required at the end of the semester.
- The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

PRE-REQUISITE: Course Code: All core courses & Laboratories

TOTAL: 300 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Project Work		**Course Code :** 20EC8L1
CO	**Course Outcomes**	**K-CO**
C404.1	Identify and apply solutions to real-world, societal, and sustainability-oriented problems in Electronics and Communication Engineering and allied domains, considering ethical, environmental, and social impacts.	K4
C404.2	Identify, analyze, design, implement, and manage prototype-level engineering projects using a systematic and structured problem-solving methodology, ensuring technical feasibility and effectiveness.	K4
C404.3	Apply modern engineering and simulation tools (such as MATLAB, Multisim, Proteus, NS-2/NS-3, CAD tools, and embedded platforms) to model, analyze, design, and validate engineering solutions.	K4
C404.4	Function effectively as an individual, team member, or team leader in the planning, development, and execution of technical projects, demonstrating collaboration and responsibility.	K4
C404.5	Develop effective oral, written, and visual communication skills to present project objectives, methodologies, results, and conclusions clearly to technical and non-technical audiences.	K4
C404.6	Prepare technical reports, project documentation, and examinations following professional ethics, academic integrity, and engineering standards, demonstrating accountability and lifelong learning attitude.	K4

20ECV11	CAD for VLSI CIRCUITS	L	T	P	C
		2	0	2	3

OBJECTIVE:

- To study various physical design methods in VLSI.
- To understand the concepts behind the VLSI design rules and routing techniques.
- To use the simulation techniques at various levels in VLSI design flow.
- To understand the concepts of various algorithms used for floor planning and routing techniques.

PRE-REQUISITE:

Course Code: 20CS303, 20EC505
Course Name: Object Oriented Programming and Data Structures,
Digital VLSI Design and FPGA Implementation

UNIT - I VLSI DESIGN METHODOLOGIES **6**

Introduction to VLSI Design methodologies - Review of Data structures and algorithms - Review of VLSI Design automation tools - Algorithmic Graph Theory and Computational Complexity.

LAB COMPONENT

1. Demonstration of Cadence tools' digital design flow
2. Simulation and synthesis of multiplier circuits. **6**

UNIT - II DESIGN RULES AND FLOOR PLANNING **6**

Design rules - algorithms for constraint - graph compaction - placement and partitioning – Placement algorithms - partitioning algorithms - Floorplanning concepts - shape functions and floorplan sizing.

LAB COMPONENT

3. Create the floorplan and power plan for the multiplier circuits. **6**

UNIT - III SIMULATION AND SYNTHESIS IN CAD **6**

Classification of pin assignment problems - Types of local routing problems - Area routing - channel routing - global routing - algorithms for global routing.

LAB COMPONENT

4. Create the global and local routing plan for the multiplier circuits. **6**

UNIT - IV PHYSICAL DESIGN IMPLEMENTATION **6**

Placement & Placement Optimizations - CTS & CTS Optimizations - Routing & Routing Optimizations - Physical Verification (DRC, LVS, ERC) - DFM Checks - Formal Verification (LEC) - Parasitic Extraction (RC Extraction).

LAB COMPONENT

5. Create the clock tree synthesis for the multiplier circuits.
6. Physical verification for the designed multiplier circuits. **6**

UNIT - V DESIGN ANALYSIS **6**

Timing Analysis: Dynamic vs. Static Timing Analysis, Static Timing Analysis (STA) - Congestion Analysis - Power Analysis: Dynamic Power Analysis, Static Power Analysis - IR Drop Analysis: Dynamic IR Drop Analysis, Static IR Drop Analysis.

LAB COMPONENT

7. Parasitic Extraction and Static timing analysis of the designed multiplier circuits. **6**

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Andrew B. Kahng, Jens Lienig, Igor L. Markov and Jin Hu, “VLSI Physical Design: From Graph Partitioning to Timing Closure”, Springer Science, 2011.
2. Niranjan N. Chiplunkar and Manjunath Kotari, “VLSI CAD”, Prentice Hall of India, 2011.

REFERENCES:

1) Wolfgang Fichtner and Martin Morf, “VLSI CAD Tools and Applications”, Springer, 2011.
2) S.H.Gerez, "Algorithms for VLSI Design Automation", John Wiley & Sons, 2002.
3) N.A.Sherwani, "Algorithms for VLSI Physical Design Automation", Kluwer Academic Publishers, 2002.
4) Sadiq M. Sait and Habib Youssef, “VLSI Physical Design automation: Theory and Practice”, World scientific 1999.
5) Steven M. Rubin, “Computer Aids for VLSI Design”, Addison Wesley Publishing 1987.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : CAD for VLSI Circuits		**Course Code :** 20ECV11
CO	**Course Outcomes**	**K-CO**
C326.1	Illustrate the fundamental design methodologies of VLSI circuits.	K3
C326.2	Summarize the various standard VLSI design automation rules and tools.	K3
C326.3	Discuss the concepts floor planning, pin assignment and routing algorithms.	K2
C326.4	Apply the CAD techniques to solve the given circuit design.	K3
C326.5	Summarize the logics involved in simulation, synthesis and verification of digital circuits.	K3
C326.6	Illustrate the logic synthesis and verification techniques.	K3

20ECV12 DIGITAL COMMUNICATION RECEIVERS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic principles of digital communication techniques.
- To gain knowledge about receivers for AWGN channel and Fading channels.
- To understand the concepts of synchronization and adaptive equalization techniques.

PRE-REQUISITE:

Course Code: 20EC510
Course Name: Analog and Digital Communication Techniques

UNIT - I REVIEW OF DIGITAL COMMUNICATION TECHNIQUES 9

Digital communication system - communication channels and their characteristics - Mathematical model for communication channel.

UNIT - II SIGNAL SPACE REPRESENTATION 9

Representation of Band Pass Signals - Representation of Linear Band-Pass Systems - Response of a Band-Pass System to Band-Pass Signal - Vector Space Concepts - Signal Space Concepts - Orthogonal Expansions of Signals - Memoryless Modulation Methods - Linear Modulation with Memory.

UNIT - III OPTIMUM RECEIVERS FOR AWGN CHANNEL 9

Correlation Demodulator - Matched Filter Demodulator - The Optimum Detector - The Maximum-Likelihood Sequence Detector - A Symbol-by-Symbol MAP Detector for Signal with Memory.

UNIT - IV RECEIVERS FOR FADING CHANNELS 9

Optimum Receiver for Binary Signals - Optimum Receiver for M-ary Orthogonal - Probability of Error for Envelope Detection of M-ary Orthogonal Signals.

UNIT - V CHARACTERIZATION OF BAND LIMITED CHANNEL 9

Characterization of Band-Limited Channels - Signal Design for Band-Limited Channels - Optimum Receiver for Channels with ISI and AWGN - Optimum Maximum-Likelihood Receiver - A Discrete-Time Model for a Channel with ISI - The Viterbi Algorithm for the Discrete-Time White Noise Filter Model - Performance of MLSE for Channels with ISI.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Digital Communication Receiver		**Course Code :** 20ECV12
CO	**Course Outcomes**	**K-CO**
C320.1	Derive the communication Model.	K2
C320.2	Compute the vector space diagram for the given modulation systems.	K3
C320.3	Explain the correlation receiver and matched filter concepts.	K2
C320.4	Explain ML and MAP detectors.	K2
C320.5	Compute the Probability error for the given modulation systems.	K3
C320.6	Explain the performance measure of band limited channel.	K2

TEXT BOOKS:

1. Heinrich Meyer, Mare Moeneclacy and Stefan A. Fechtel, “Digital Communication Receivers: Synchronization, Channel Estimation, and Signal Processing”, John Wiley, New York, 2001.
2. U.Mengali and A.N.D.Andrea, “Synchronization Techniques for Digital Receivers”, Kluwer, 1997.

REFERENCES:

1. John G. Proakis, “Digital communication”, 4th Edition, McGraw-Hill, New York, 2001.
2. E.A.Lee and D.G.Messerschmitt, “Digital communication”, 2nd Edition, Allied Publishers, New Delhi, 1994.
3. Simon Marvin, “Digital communication over fading channel: An unified approach to performance Analysis”, John Wiley, New York, 2000.
4. H.Meyr and G.Ascheid, “Synchronization in Digital Communications”, John Wiley, 1990.
5. R.G.Gallager, “Principles of Digital Communication”, Cambridge University Press, 2008.

20ECV13	SPEECH PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire the fundamentals of the digital signal processing that allows them to assimilate the concepts related to the speech processing.
- To present basic principles of speech analysis.
- To give an overview of speech processing applications including speech enhancement, speech recognition and speaker recognition.
- To give fundamentals of Pattern recognition and application of ANN.

PRE-REQUISITE:

Course Code: 20EC405
Course Name: Principles of Digital Signal Processing

UNIT - I FUNDAMENTALS OF SPEECH PROCESSING 9

Introduction to speech processing – Speech communications – anatomy and physiology of the speech production system – Phonemics and Phonetics – Acoustic theory of speech production – Discrete time modeling Single lossless tube analysis – two tube lossless model of the vocal tract – Fast Discrete time transfer function calculation.

UNIT - II SPEECH ANALYSIS TECHNIQUES 9

Short term processing of speech - Short term measures from long term concepts – Examples of short term features and applications.
Long- term LP analysis by system identification – Short – term LP analysis – Ideal, almost ideal and Non-ideal cases – Alternative representations of the LP coefficients – Applications of LP in Speech analysis.
Cepstral analysis: real cepstrum and complex cepstrum – Critical analysis of the cepstrum.

UNIT - III SPEECH CODING, ENHANCEMENT AND QUALITY ASSESSMENT 9

Speech Coding and Synthesis: Optimum scalar and vector quantization – Waveform coding – Vocoders – Measuring of quality of speech compression.
Speech Enhancement: Classification of Speech Enhancement methods – Short – term spectral amplitude techniques – Speech modeling and wiener filtering – Adaptive noise canceling – systems based on fundamental frequency tracking – performance evaluation.
Speech quality assessment: subjective and objective quality measures.

UNIT - IV SPEECH RECOGNITION AND HIDDEN MARKOV MODELS 9

Dimensions of difficulty in recognition – speaker recognition and verification – Dynamic time warping: dynamic programming (DTW) – DTW applied to isolated word recognition (IWR) – DTW applied to continuous speech recognition (CSR).
Hidden Markov Models: Theoretical developments – practical Issues – IWR without syntax – CSR by the connected-word strategy without syntax – language modeling using HMM.

UNIT - V PATTERN CLASSIFICATION AND ANN 9

Feature extraction – classification methods – support vector machines – unsupervised clustering – Class related probability functions – minimum error classifications – likelihood based MAP classification – Bayes classifier – statistically based linear discriminants – iterative training: EM algorithm.
Network principles and paradigms - Applications of ANNs in speech recognition.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Speech Processing		**Course Code :** 20ECV13
CO	**Course Outcomes**	**K-CO**
C321.1	Explain the fundamental concept of speech processing.	K2
C321.2	Describe the analysis techniques of speech signal with its applications.	K2
C321.3	Illustrate the coding and enhancement of speech signal with its quality assessment.	K3
C321.4	Explain the speech recognition and hidden Markov models.	K2
C321.5	Explain the fundamental concept of speech processing.	K2
C321.6	Explain the applications of ANN using speech processing.	K2

TEXT BOOKS:

1. Ben Gold Nelson Morgan and Dan Ellis, “Speech and Audio signal processing”, John Wiley & Sons Inc., Second Edition, 2011.
2. Joh R. Deller, John H.L. Hanse and John G. Proakis, “Discrete Time processing of speech signals”, John Wiley & Sons, Inc., 2000.

REFERENCES:

1. Lawrence Rabiner and Biing – Hwang Juang, “Fundamentals of speech recognition”, Pearson Education, 2003.

20ECV14	MACHINE LEARNING AND APPLICATIONS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the need for machine learning for various problem solving.
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning.
- To understand the latest trends in machine learning.
- To design appropriate machine learning algorithms for problem solving.

PRE-REQUISITE: NIL

UNIT - I SUPERVISED LEARNING: REGRESSION **6**

Paradigms of Machine Learning - examples - Types of Learning - Types of supervised learning - Introduction to Regression - Linear regression - Geometrical Interpretation - Iterative solution: Gradient descent - Performance metrics of machine learning.

LAB COMPONENT

1. Installing Anaconda - Jupiter Notebook - Learn Python ML Packages.
2. Implement data loading methods - understanding data with statistics, visualization - Data Preprocessing - Data Labeling. **6**

UNIT - II SUPERVISED LEARNING: CLASSIFICATION **6**

K-Nearest Neighbour Classification - Distance metric and Cross-Validation - Computational efficiency of KNN - Introduction to Decision Trees - Entropy and Information Gain - Naive Bayes classifier - Perceptron and its learning algorithm.

LAB COMPONENT

3. Logistic Regression Implementation: Implement the standard Logistic Regression model generally used for classifying data into binary classes such as pass/fail, win/lose, alive/dead or healthy/sick.
4. Decision Tree Implementation: Implement the standard Decision Tree Class used for classifying data into various classes using a tree-like model of decisions and their possible consequences. **6**

UNIT - III UNSUPERVISED LEARNING **6**

K-means Clustering – Llyod's Algorithms - Convergence and Initialization - Covariance Matrix and Eigen direction.

LAB COMPONENT

5. Tumor Prediction: Detect Brain tumor images from the given data set.
6. Heart disease Prediction- Detect heart blockage images from the given data set. **6**

UNIT - IV RECOMMENDER SYSTEMS **6**

Recommender Systems - Introduction - Non-Personalized Recommender Systems - Content-Based Recommender Systems - Recommender System Evaluation.

LAB COMPONENT

7. Movie/Book/Any Product recommendation by using content-based filtering. **6**

UNIT - V OPTIMIZATION FOR WIRELESS COMMUNICATION **6**

Introduction to Applied Optimization - Least Squares problem - Geometric Intuition for Least Squares - Multi Antenna Channel Estimation - Image Deblurring - Regularization - Spectrum sensing - Linear classification.

LAB COMPONENT

8. Spectrum sensing by using linear classification. **6**

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Machine Learning and Applications		**Course Code :** 20ECV14
CO	**Course Outcomes**	**K-CO**
C322.1	Identify the category of the learning problem, and measure it's performance like recall, precision etc.	K3
C322.2	Apply the classification algorithms like K-NN, Decision Tree, Naive Bayes, Logistic Regression to classify the dataset.	K3
C322.3	Apply unsupervised algorithms namely K-means and PCA to cluster the given dataset.	K3
C322.4	Apply Content-based recommender systems and Collaborative Filtering to implement recommender systems.	K3
C322.5	Identify and analyze the problem and apply machine learning techniques to solve real world applications.	K4
C322.6	Formulate a classification model using suitable machine learning techniques.	K4

TEXT BOOKS:

1. Marc Peter Deisenroth, A. Aldo Faisal and Cheng Soon Ong, "Mathematics for Machine Learning", Cambridge University Press, 2020.
2. Gopal sakarkar, gaurav patil and prateek dutta, "Machine Learning Algorithms using Python Programming", Nova Science Publishers, New York, 2021.

REFERENCES:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (India) Private Limited, 2013.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", CRC Press, 2009.
3. Mehryar Mohri, Afshin Rostamizadeh and Ameet Talwalkar, "Foundations of Machine Learning", MIT Press, 2012.
4. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning)", The MIT Press, 2004.

20ECV15	IOT ENABLED SYSTEM DESIGN	L	T	P	C
		2	0	2	3

OBJECTIVE:

- To appraise students with basic knowledge of IoT that paves a platform to understand physical and logical design of IOT.
- To teach a student how to analyse requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms.
- To introduce the technologies behind Internet of Things (IoT).
- To explain the students how to code for an IoT application using Raspberry Pi open platform.
- To understand the various applications in IoT.

PRE-REQUISITE:

Course Code: 20EC511
Course Name: Microprocessor and Microcontroller based systems

UNIT - I INTRODUCTION TO INTERNET OF THINGS 6

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT.

LAB COMPONENT

1. Study of different operating systems and installation for Raspberry Pi. **6**

UNIT - II COMMUNICATION TECHNOLOGIES OF IoT 6

Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Communication modules (Bluetooth, Zigbee, Wi-Fi, GPS, GSM Modules)

LAB COMPONENT

2. Interface various sensors and communication modules with Raspberry Pi. **6**

UNIT - III PROTOCOLS AND TECHNOLOGIES BEHIND IoT 6

IoT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, Big Data Analytics, Cloud Computing.

LAB COMPONENT

3. Develop a server application by using suitable IoT protocol **6**

UNIT - IV OPEN PLATFORMS AND PROGRAMMING 6

IOT deployment for Raspberry Pi platform - Architecture - Programming - Interfacing - Accessing GPIO Pins - Sending and Receiving Signals Using GPIO Pins - Connecting to the Cloud.

LAB COMPONENT

4. Interface the Raspberry Pi with cloud to trans-receive data from sensors and actuators. **6**

UNIT - V APPLICATIONS AND CASE STUDIES 6

Business models for the internet of things - Smart city - Smart mobility and transport - Industrial IoT - Smart health - Environment monitoring and surveillance - Home Automation - Smart Agriculture.

LAB COMPONENT

5. Design business model and deploy Home Automation using Raspberry Pi **6**

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.
2. Samuel Greengard, The Internet of Things, The MIT Press, 2015.

REFERENCES:

1. Perry Lea, "Internet of things for architects", Packt, 2018.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012.
3. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015.
4. Peter Waher, "Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3", First Edition, Packt Publishing, 2018.
5. John C. Shovic, "Raspberry Pi IoT Projects: Prototyping Experiments for Makers", Packt Publishing, 2016.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : IoT Enabled System Design		**Course Code :** 20ECV15
CO	**Course Outcomes**	**K-CO**
C324.1	Explain IoT architecture, fog, edge and cloud computing.	K2
C324.2	Build an IoT ecosystem that interfaces with various hardwares and wireless communication modules.	K3
C324.3	Make use of data analytics and cloud computing to develop an application with suitable IoT protocol.	K3
C324.4	Demonstrate the use of GPIO pins to interface raspberry pi with cloud.	K3
C324.5	Discuss different business models for IoT.	K2
C324.6	Identify any societal problem and solve by applying acquired knowledge of IoT enabled system design.	K3

20ECV16	FOUNDATIONS FOR NANO ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To introduce quantum mechanics concepts, approximations and statistical mechanics for understanding nano systems.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION TO QUANTUM MECHANICS 9

Particles – waves – probability amplitudes – Schrodinger equation – wave packets solutions – operators – expectation values – eigen functions – piecewise constant potentials.

UNIT - II SIMPLE HARMONIC OSCILLATORS AND APPROXIMATIONS 9

SHM Operators – SHM wave packet solutions – Quantum LC circuit – WKB approximations – variational methods.

UNIT - III SYSTEMS WITH TWO AND MANY DEGREES OF FREEDOM 9

Two level systems with static and dynamic coupling – problems in more than one dimensions – electromagnetic field quantization – density of states.

UNIT - IV STATISTICAL MECHANICS 9

Basic concepts – microscopic – quantum systems in equilibrium – statistical models applied to metals and semiconductors.

UNIT - V APPLICATIONS 9

Hydrogen and Helium atoms – electronic states – Atomic force microscope – Nuclear Magnetic Resonance – Carbon nanotube properties and applications.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Foundations For Nano Engineering		**Course Code :** 20ECV16
CO	**Course Outcomes**	**K-CO**
C325.1	Apply mathematical tools to solve the problems of quantum mechanics.	K3
C325.2	Comprehend the significance of simple harmonic oscillators.	K2
C325.3	Apply the fundamentals of quantum mechanics to solve the one or two dimensional problems.	K3
C325.4	Explain the fundamentals of statistical mechanics.	K2
C325.5	Apply the fundamental knowledge of statistical mechanics to develop statistical models in metals and semiconductors.	K3
C325.6	Explain the application of Nano Electronics in the area of Helium & Hydrogen atoms, atomic force microscope, Nuclear magnetic resonance and Carbon nano tube.	K2

TEXT BOOKS:

1. Rainer Waser, “Nanoelectronics and Information Technology”, Wiley, Third Edition, 2012.
2. Hagelstein L. Peter, Stephen D. Senturia and Terry P. Orlando, “Introduction to Applied Quantum and Statistical Physics”, Wiley, New York, 2004.

REFERENCES:

1. Michael A. Nielsen and Isaac L. Chuang, “Quantum Computation and Quantum Information”, Cambridge University Press, 2000.
2. Neil Gershenfeld, “The Physics of Information Technology”, Cambridge University Press, 2000.
3. Adrian Ionesu and Kaustav Banerjee, “Emerging Nanoelectronics Life with and after CMOS”, Vol I, II, and III, Kluwer Academic, 2005.

20ECV21	MULTICORE PROGRAMMING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the need for multi-core processors, and their architecture.
- To understand the challenges in parallel and multi-threaded programming.
- To learn about the various parallel programming paradigms.
- To develop multicore programs and design parallel solutions.

PRE-REQUISITE:

Course Code: 20EC402, 20EC511, 20EC505

Course Name: Computer Architecture and Organization, Microprocessor and Microcontroller based systems, Digital VLSI Design and FPGA Implementation

UNIT - I MULTI-CORE PROCESSORS **6**

Single core to multi-core architectures – SIMD and MIMD systems – Interconnection networks – Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues – Parallel program design.

LAB COMPONENT

1. Controlling the Number of Threads on Multiple Nesting Levels. **6**

UNIT - II PARALLEL PROGRAM CHALLENGES **6**

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

LAB COMPONENT

2. Create a program that computes a simple matrix vector multiplication b=Ax, in C/C++. Use OpenMP directives to make it run in parallel. **6**

UNIT - III SHARED MEMORY PROGRAMMING WITH OPENMP **6**

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations.

LAB COMPONENT

3. Create a program that computes the sum of all the elements in an array A in C/C. Use OpenMP directives to make it run in parallel. **6**

UNIT - IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI **6**

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation.

LAB COMPONENT

4. Implement a parallel version of the Jacobi algorithm using OpenMP. **6**

UNIT - V PARALLEL PROGRAM DEVELOPMENT **6**

Case studies: n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

LAB COMPONENT

6

Create a program that computes the adjusted prefix sum below for 4 different arrays and after that adds all of them up. Use OpenMP directives to make it run in parallel.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Thomas Rauber and Gudula Rünger, "Parallel Programming", Springer Berlin, Heidelberg, 2013.
2. Darryl Gove, "Multicore Application Programming for Windows, Linux, and Oracle Solaris", Pearson, 2011.

REFERENCES:

1. Michael Quinn, "Parallel programming in C with MPI and OpenMP", McGraw-Hill Education, 2003.
2. Victor Alessandrini, "Shared Memory Application Programming: Concepts and Strategies in Multicore Application Programming", Morgan Kaufmann, First Edition, 2015.
3. Yan Solihin, "Fundamentals of Parallel Multicore Architecture", Chapman and Hall/CRC, First Edition, 2015.
4. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan-Kauffman/Elsevier, 2011.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Multicore Programming		**Course Code :** 20ECV21
CO	**Course Outcomes**	**K-CO**
C326.1	Describe multicore architectures and identify their characteristics and challenges.	K2
C326.2	Compare and contrast programming for serial processors and programming for parallel processors.	K2
C326.3	Determine the issues in programming Parallel Processors.	K3
C326.4	Develop the programs using OpenMP.	K3
C326.5	Develop the programs for data-level parallelism and thread-level parallelism.	K3
C326.6	Design the parallel programming solutions to common problems.	K3

20ECV22	SATELLITE COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of satellite orbits.
- To analyze the geo stationary and non geo-stationary orbits.
- To acquire the knowledge about launching procedures.
- To study satellite system engineering, orbital mechanism, orbital effects on communication etc.
- To study and analysis of multiplexing and multiple access techniques.
- To study and analysis of earth station antenna and equipment.

PRE-REQUISITE: NIL

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 - Link budget calculations -Uplink and Downlink of a satellite link - Atmospheric Losses-Interference analysis - Rain induced attenuation and interference - Ionospheric characteristics -Ionospheric Effects - Link Design with and without frequency reuse.

UNIT - IV SATELLITE ACCESS AND CODING METHODS 9

Modulation and Multiplexing: Voice, Data, Video - Analog and digital transmission system - Digital video Broadcast. Multiple accesses: 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) -Indian Regional Navigation Satellite System (IRNSS).

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Satellite Communication		**Course Code :** 20ECV22
CO	**Course Outcomes**	**K-CO**
C327.1	Describe the Extended and reusable satellite launching vehicles and launching procedures of satellite systems.	K3
C327.2	Explain about the satellite space segment with various satellite subsystems.	K2
C327.3	Derive the satellite Link design with uplink, downlink, rain effects and Ionospheric characteristics.	K3
C327.4	Apply accessing schemes such as TDMA, FDMA and CDMA for satellite communication.	K3
C327.5	Illustrate various satellite applications such as Intelsat series and Mobile satellite services.	K3
C327.6	Discuss about Satellite Navigational System - Direct Broadcast satellites (DBS/DTH), Indian Regional Navigation Satellite System (IRNSS).	K3

TEXT BOOKS:

1. Louis J. Ippolito Jr., “Satellite Communications Systems Engineering: Atmospheric Effects, Satellite Link Design and System Performance”, Wiley, Second Edition, 2017.
2. Gerard Maral, Michel Bousquet and Zhili Sun, “Satellite Communications Systems: Systems, Techniques and Technology”, Wiley, Fifth Edition, 2010.

REFERENCES:

1. Wilbur L. Pritchard, Hendri G. Suyderhoud and Robert A. Nelson, “Satellite Communication Systems Engineering”, Prentice Hall/Pearson, 2007.
2. Dennis Roddy, “Satellite Communication”, Mc Graw Hill International, Fourth Edition, 2006.
3. Timothy Pratt, Charles W. Bostain and Jeremy E. Allnutt, “Satellite Communication”, John Wiley & Sons, Second Edition, 2003.
4. M.Richharia, “Satellite Communication Systems: Design Principles”, Mac Millan, 2003.

20ECV23 ADVANCED DIGITAL SIGNAL PROCESSING

L	T	P	C
2	0	2	3

OBJECTIVES:

- To learn the concepts of stationary and non-stationary random signals and characterization of discrete time random process.
- To estimate power spectral density of random process.
- To derive adaptive filter algorithm.
- To analyze multi rate signal processing.

PRE-REQUISITE:

Course Code: 20EC405
Course Name: Principles of Digital Signal Processing

UNIT - I DISCRETE TIME RANDOM PROCESS 6

Review of Random Variables: Definitions - Ensemble averages - Jointly distributed random variables - Joint moments - Independent, uncorrelated and orthogonal random variables. Review of Random Process: Definitions - Ensemble averages - Gaussian Processes - Stationary processes - Auto covariance and auto correlation matrices - ergodicity - white noise. Power spectrum. Filtering of random process - Spectral factorization.

LAB COMPONENT

1. Estimation of statistical parameters for a given random signal. **6**
2. Estimation of Auto correlation matrix, Power spectral density, and cross power spectral density using MATLAB.

UNIT - II SPECTRUM ESTIMATION – NON-PARAMETRIC METHODS 6

Non parametric methods: The periodogram - performance of the periodogram - The modified periodogram - Bartlett's method - Welch's method - Blackman-Tukey approach - Performance comparisons.

LAB COMPONENT

3. Finding PSD using various Methods (periodogram, modified periodogram) using MATLAB. **6**

UNIT - III SPECTRUM ESTIMATION – PARAMETRIC METHODS 6

Parametric methods: Auto regressive spectrum estimation - BURG method - moving average spectrum estimation - ARMA spectrum estimation. Frequency estimation: Eigen decomposition of the auto correlation matrix.

LAB COMPONENT

4. Finding PSD-BURG method for AR model using MATLAB. **6**
5. Estimation of frequency using Eigen decomposition.

UNIT - IV OPTIMUM LINEAR FILTERS 6

Wiener filters for filtering and prediction: FIR Wiener filter - Orthogonality principle in Linear mean square estimation - IIR Wiener filter - Non causal wiener filter

LAB COMPONENT

6. Simulation of Weiner filtering FIR using MATLAB. **6**
7. Simulation of Weiner filtering IIR using MATLAB.

UNIT - V ADAPTIVE FILTERS 6

Adaptive Direct Form FIR filter: Minimum Mean square error Criterion - LMS algorithm - Applications of adaptive filters: adaptive channel equalization - Adaptive noise cancelling.

LAB COMPONENT

8. Adaptive noise cancellation using MATLAB. **6**
9. Adaptive channel equalization of LMS adaptive filter using MATLAB.

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Advanced Digital Signal Processing		**Course Code :** 20ECV23
CO	**Course Outcomes**	**K-CO**
C328.1	Apply the fundamental concept of random process and random variable to derive the statistical parameters while filtering the random process.	K3
C328.2	Compute spectrum estimation using parametric and non parametric methods.	K3
C328.3	Apply the prediction methods to compute the reflection parameters.	K3
C328.4	Compute prediction error and mean square error Lattice and Wiener filters respectively.	K3
C328.5	Apply adaptive filter algorithms to compute the filter coefficients for the given applications.	K2
C328.6	Analyze the spectral characteristics for the output signal of the decimator and interpolator.	K4

TEXT BOOKS:

1. Monson H. Hayes, “Statistical Digital signal Processing and Modeling”, Wiley, 2012.
2. John G. Proakis and Dimitris G. Manolakis, “Digital Signal Processing – Principles, Algorithms and Applications”, Pearson Education, Fourth Edition, 2016.

REFERENCES:

1. Vinay K. Ingle and John G. Proakis, “Digital signal Processing using MATLAB” Cengage Learning, Third Edition, 2012.
2. Simon Haykin, “Adaptive Filter Theory”, Pearson Education, Fifth Edition, 2014.
3. Emmanuel C. Ifeacher and Barrie W. Jervis, “DSP-A Practical approach”, Pearson Education, Second Edition, 2002.
4. Jian Wang and Barmak Honarvar Shakibaei Asli, “Advanced Digital Signal Processing**”,** Scitus Academics, 2019.
5. Dr. Shaila D Apte, “Advanced Digital Signal Processing”, Wiley, 2021.

20ECV24 ARTIFICIAL INTELLIGENCE FOR EVERYONE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various characteristics of Intelligent agents.
- To study the different search strategies in AI.
- To learn techniques in solving AI problems.
- To understand the different ways of designing software agents.
- To learn the various applications of AI.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION **9**

Introduction to AI - Definition - Compare with human intelligence and traditional information processing - strengths and limitations - Future of AI - Characteristics of Intelligent Agents - Typical Intelligent Agents - Problem Solving Approach to Typical AI problems.

UNIT - II PROBLEM SOLVING METHODS **9**

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

UNIT - III KNOWLEDGE REPRESENTATION **9**

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

UNIT - IV BUILDING AI PROJECTS **9**

Workflow of a machine learning project - Workflow of a data science project - how to use data - Technical tools for AI - Case study: Smart speaker, Self-driving car, AI Transformation Playbook, Population Scale Healthcare.

UNIT - V ARTIFICIAL INTELLIGENCE ON THE CLOUD **9**

Cloud migration - Cloud providers - Conversational agents - Natural language processing - Image and video processing - Translation - Machine learning platform -Transcription - Document analysis.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Artificial Intelligence for Everyone		**Course Code :** 20ECV24
CO	**Course Outcomes**	**K-CO**
C329.1	Explain the fundamentals of artificial intelligence.	K2
C329.2	Apply the appropriate searching algorithms for the given artificial intelligence problems.	K3
C329.3	Formulate a problem using first order and predicate logic.	K3
C329.4	Develop Artificial Intelligence projects for solving the practical problems of current interest using the strategies introduced during the course.	K3
C329.5	Develop proficiency in applying scientific methods to model the machine learning applications.	K3
C329.6	Solve the artificial intelligence problems using the facilities of cloud systems.	K3

TEXT BOOKS:

1. S.Russell and P.Norvig, “Artificial Intelligence: A Modern Approach”, Pearson Publishers, Fourth Edition, 2021.
2. Alberto Artasanchez and Prateek Joshi, “Artificial Intelligence with Python”, Packt Publishing, Second Edition, 2020.

REFERENCES:

1. Ivan Bratko, “Prolog Programming for Artificial Intelligence”, Addison-Wesley, Fourth Edition, 2011.
2. M.Tim Jones, “Artificial Intelligence: A Systems Approach”, Jones & Bartlett Learning, First Edition, 2009.
3. Nils J. Nilsson, “The Quest for Artificial Intelligence: A History of Ideas and Achievements”, Cambridge University Press, 2009.
4. Zoltán Somogyi, “The Application of Artificial Intelligence”, Springer Nature, 2021.
5. S.Kanimozhi Suguna, M.Dhivya and Sara Paiva, “Artificial Intelligence (AI): Recent Trends and Applications”, CRC Press, 2021.

20ECV25	MIXED C AND ASSEMBLY LANGUAGE PROGRAMMING	L	T	P	C
		2	0	2	3

OBJECTIVE:

- To understand link between the Microprocessors and C programming
- To realize how a C program is translated into assembly language and how it eventually gets executed on a microprocessor
- To research what happens in the stack, data and code segment, of the microprocessor when a C program is executed
- To describe how to write a mixture of C, C++, and assembly language code for the ARM architecture.

PRE-REQUISITE:

Course Code: 20CS304, 20EC511
Course Name: Object Oriented Programming and Data Structures, Microprocessor and Microcontroller based systems

UNIT - I OVERVIEW OF MICROPROCESSOR PROGRAMMING (8086) 6

Overview of Microprocessors and Assembly language Programming - Microprocessor Architecture - Machine Language - Execution Sequence in a Microprocessor - Memory in a Microprocessor - Instruction Set - Addressing Schemes - Flags - Registers - Stacks.

LAB COMPONENT

1. Write a program for instructions call and ret hardware loops. **6**

UNIT - II C PROGRAMMING 6

Overview of C - Inline Assembly Data types and their sizes - String length - Multiplication using repeated addition - Swap two variables in C - Swap two variables in inline Assembly Function - Swap two variable in C Inline code - swap the two variables using a function.

LAB COMPONENT

2. Write the simple example programs for inline assembly ALU operations. **6**

UNIT - III COMPILATION OF C, C++ AND ASSEMBLY 6

Compiling C to Assembly Language - Compiling a simple program to Assembly - First order Passing parameters - Prologue Epilogue Local variables - C++ and Some special Functions of C and C++ at assembly language level - Special functions using memcpy and strlen.

LAB COMPONENT

3. Give examples for recursion vs. loops with factorial. **6**

UNIT - IV MIXTURE OF C, C++ AND ASSEMBLY LANGUAGE CODE 6

Instruction intrinsic - Inline and embedded assembler - Access to C global variables from assembly code - Mixed-language programming - Rules for calling between C, C++, and assembly language - Rules for calling C++ functions from C and assembly language - Information specific to C++.

LAB COMPONENT

4. Write a program for including system C header files from C++.
5. Write a program for including your own C header files from C++. **6**

UNIT - V MIXED-LANGUAGE PROGRAMMING 6

Calls to assembly language from C - Calls to C from assembly language - Calls to C++ from C - Calls to C++ from assembly language - Passing a reference between C and C++ - Calls to C++ from C or assembly language.

LAB COMPONENT

6. Write the program for calls to C from C++.
7. Write the program for calls to assembly language from C++. **6**

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Mixed C and Assembly Language Programming		**Course Code :** 20ECV25
CO	**Course Outcomes**	**K-CO**
C330.1	Describe the architecture and organization of microprocessor along with instruction set format.	K2
C330.2	Recollect various programming constructs to develop C programs.	K2
C330.3	Develop the C and assembly language programs using various programming tools.	K3
C330.4	Describe the object-oriented programming approach in connection with C++.	K3
C330.5	Apply the programming knowledge of C, C++ and assembly language in the development of mixed programming concept.	K3
C330.6	Implement simple programs using mixed programming language.	K3

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TEXT BOOKS:

1. Brian W. Kernighan and Dennis Ritchie, “The C Programming Language”, Pearson Education India, Second Edition, 2015.
2. Yifeng Zhu, “Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C”, E-Man Press LLC, Third Edition, 2017.

REFERENCES:

1. Stanley Lippman, Josée Lajoie and Barbara Moo, “C++ Primer”, Addison-Wesley Professional, Fifth Edition, 2012.
2. Mike Hendrickson, Andrew Koenig and Barbara Moo, “Accelerated C++: Practical Programming by Example (C++ In-Depth Series)”, Addison-Wesley, First Edition, 2000.
3. Randall Hyde, “The Art of Assembly Language”, No Starch Press, Second Edition, 2010.
4. Barry B. Brey, “The Intel Microprocessors - Architecture, Programming, and Interfacing”, Pearson Education India, Eight Edition, 2008.
5. Igor Zhirkov, “Low-Level Programming: C, Assembly, and Program Execution on Intel 64 Architecture”, Apress, First Edition, 2017.

20ECV26	SENSOR CONCEPTS AND TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide in depth knowledge in physical principles applied in sensing and measurement.
- To give a fundamental knowledge on the basic laws and phenomena on which operation of sensor transformation of energy is based.
- To impart a reasonable level of competence in the design, construction, and execution of mechanical measurements strain, force, torque and pressure.
- To familiarize with different sensors and transducers.
- To explain smart sensors and biosensors.

PRE-REQUISITE: NIL

UNIT - I SENSORS AND TRANSDUCERS 9

Principles - Classification - Parameters - Characteristics - Environmental Parameters (EP) - Characterization. Inductive Sensors: Sensitivity and Linearity of the Sensor, Types- Capacitive Sensors: Electrostatic Transducer - Force/Stress Sensors using Quartz Resonators - Ultrasonic Sensors.

UNIT - II THERMAL AND MAGNETIC SENSORS 9

Introduction - Gas thermometric Sensors - Thermal Expansion Type - Thermometric Sensors - Acoustic Temperature Sensor - Dielectric Constant and Refractive Index thermo sensors - Magnetic Thermometer - Resistance Change Sensors and the Principles Behind - Magneto-resistive Sensors - Semiconductor Magneto resistors - Hall Effect and Sensors - Inductance and Eddy Current Sensors.

UNIT - III RADIATION AND ELECTRO ANALYTICAL SENSORS 9

Introduction - Basic Characteristics - Types of Photosensistors/Photo detectors – X ray and Nuclear Radiation Sensors – Fiber Optic Sensors, the Electrochemical Cell- The Cell Potential - Standard Hydrogen Electrode (SHE) - Liquid Junction and Other Potentials - Polarization – Concentration Polarization - Reference Electrodes - Sensor Electrodes - Electro ceramics in Gas Media.

UNIT - IV SMART SENSORS 9

Introduction - Primary Sensors - humidity sensors - proximity sensors - fluid velocity sensors - Excitation - Amplification - Filters - Converters - Compensation - Information Coding Process - Data Communication - Standards for Smart Sensor Interface - The Automation.

UNIT - V ACTUATORS 9

Pneumatic and Hydraulic Actuation Systems- Actuation systems - Pneumatic and hydraulic systems - Directional Control valves - Pressure control valves - Cylinders - Servo and proportional control valves - Process control valves - Rotary actuators.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Sensor Concepts and Techniques		**Course Code :** 20ECV26
CO	**Course Outcomes**	**K-CO**
C331.1	Classify the transducers used for measurement of temperature, strain, motion, position and light.	K3
C331.2	Explain the construction and working of various industrial parameters and devices used to measure temperature	K2
C331.3	Explain the construction and working of semiconductor magneto resistors and synchro resolvers	K2
C331.4	Analyze the characteristics of photo sensistors, fiber optic sensors and polarization of sensor electrodes	K4
C331.5	Explain the function of primary sensors and standards for smart sensor interface.	K2
C331.6	Explain the Pneumatic and hydraulic actuation systems and functions of control valves	K2

TEXT BOOKS:

1. D.Patranabis, “Sensors and Transducers”, Prentice Hall India Learning Private Limited, Second Edition, 2003.
2. W.Bolton, “Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering”, Pearson Education, Sixth Edition, 2015.

REFERENCES:

1. Ernest O. Doebelin and Dhanesh N. Manik, “Measurement Systems: Application and Design”, McGraw Hill, Sixth Edition, 2007.
2. R.Sinclair, “Sensors and Transducers”, Newnes Publishers, Third Edition, 2001.

20ECV31	SYSTEM ON CHIP DESIGN	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To design, optimize, and program a modern System-on-a-Chip.
- To decompose the task into parallel components that cooperate to solve the problem.
- To characterize and develop real-time solutions.
- To implement both hardware and software solutions, and perform hardware/software co-design.
- To understand and estimate key design metrics and requirements.

PRE-REQUISITE :

Course Code: 20EC402, 20EC511, 20EC505

Course Name: Computer Architecture and Organization, Microprocessor and Microcontroller based systems, Digital VLSI Design and FPGA Implementation

UNIT - I INTRODUCTION TO THE SYSTEM APPROACH **6**

System Architecture – Components of the system – Hardware and Software – Processor Architectures – Memory and Addressing – System level interconnection – An approach for SOC Design – System Architecture and Complexity.

LAB COMPONENT

1. Installation of GEM 5 software.
2. Demonstration of GEM 5 software. **6**

UNIT - II PROCESSORS **6**

Introduction – Processor Selection for SOC – Basic concepts in Processor Architecture – Basic concepts in Processor Micro Architecture – Basic elements in Instruction handling – Buffers – minimizing Pipeline Delays – Branches – More Robust Processors – Vector Processors and Vector Instructions extensions – VLIW Processors – Superscalar Processors.

LAB COMPONENT

3. Design of a data processing system architecture. **6**

UNIT - III MEMORY DESIGN FOR SOC **6**

Overview of SOC external memory – Internal Memory – Size – Scratchpads and Cache memory – Cache Organization – Cache data – Write Policies – Strategies for line replacement at miss time – Types of Cache – Split – I, and D – Caches – Multilevel Caches – Virtual to real translation – SOC Memory System – Models of Simple Processor – memory interaction.

LAB COMPONENT

4. Design of a SOC memory system and pipelining set-up. **6**

UNIT - IV INTERCONNECT CUSTOMIZATION AND CONFIGURATION **6**

Inter Connect Architectures – Basic Bus Architectures – SOC Standard Buses – Analytic Bus Models – Using the Bus model – Effects of Bus transactions and contention time – Overview of SOC Customization – Customizing Instruction Processor – Reconfiguration Technologies – Mapping design onto Reconfigurable devices – Instance Specific design – Customizable Soft Processor – Overhead analysis on Reconfiguration – trade-off analysis on reconfigurable Parallelism.

LAB COMPONENT

5. Design of a SOC bus system and pipelining set-up. **6**

UNIT - V **APPLICATION STUDIES / CASE STUDIES** **6**

SOC Design approach – AES algorithms: Design and evaluation - Image compression: JPEG compression.

LAB COMPONENT

6. Implementation of AES algorithm in the SOC. **6**

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Michael J. Flynn and Wayne Luk, “Computer System Design: System-on-Chip”, Wiley India Pvt. Ltd., First Edition, 2011.
2. Steve Furber, “ARM System on Chip Architecture”, Addison-Wesley, Second Edition, 2000.

REFERENCES:

1. Ricardo Reis and Jochen A.G. Jess, “Design of System on a Chip: Devices and Components”, Springer, First Edition, 2004.
2. Jason Andrews, “Co-Verification of Hardware and Software for ARM SoC Design”, Newnes, Pap/Cdr Edition, 2004.
3. Peter Marwedel, “Embedded System Design: Embedded Systems Foundations of Cyber-Physical Systems”, Springer, Second Edition, 2011.
4. Michael Keating, “The Simple Art of SoC Design: Closing the Gap between RTL and ESL”, Springer, 2011.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : System On Chip Design		**Course Code :** 20ECV31
CO	**Course Outcomes**	**K-CO**
C332.1	Explain the functional and nonfunctional performance of the system in the design process to support design decisions.	K2
C332.2	Explain the hardware/software tradeoffs, algorithms, and architectures to optimize the system based on requirements and implementation constraints.	K2
C332.3	Analyze the characteristics of various processors for suitable SOC selection.	K3
C332.4	Analyze the various memory design techniques for SOC.	K2
C332.5	Explain the customization of interconnection methods with Reconfigurable architectures.	K3
C332.6	Estimate the issues in system-on-chip design associated with co-design, such as intellectual property, reuse, and verification.	K4

20ECV32	RF INTEGRATED CIRCUIT DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the Integrated circuit design for Amplifiers at radio frequency.
- To have exposure to microwave oscillator design.
- To imparts the concepts of RF IC.
- To analyze and focus on circuits for radio frontends for mobile phone handsets.
- To understand noise amplifiers, mixers, power amplifiers, frequency synthesizers (phase locked loops) and modern radio architectures.

PRE-REQUISITE:

Course Code: 20EC404
Course Name: Analog Electronics and Integrated Circuits

UNIT - I HIGH POWER RF TRANSISTOR AMPLIFIER DESIGN 9

FET and bipolar transistor models - Two port power gains - stability - Amplifier design using S parameters - LNA - Differential amplifiers - DC biasing - Power amplifiers - general issues: efficiency, linearity, load pull - Design: class A, class AB, class C - Higher class power amplifiers - linearization - distributed power amplifier.

UNIT - II RF OSCILLATORS 7

Microwave oscillators - LC - Colpitts - negative resistance - differential oscillators - frequency synthesis methods - phase locked loop analysis - oscillator phase noise.

UNIT - III RADIO FREQUENCY IC DESIGN 10

Introduction to RFIC basics - Historical aspects - From Maxwells to current wireless standards - the bridge between communication system designer and RFIC designer - System level parameters - circuit level parameters -Analog and microwave design versus RFIC design - noise performance estimate - RF technology - receiver with single IF stage metallization - sheet resistance - skin effect - parasitic capacitance and inductance quality factor.

UNIT - IV MICROWAVE POINT TO POINT SYSTEM DESIGN 10

Microwave transmission - link design - theoretical and practical aspects - fading design - protected and non-protected microwave systems - link design - path calculation - spread spectrum microwave system - compatibility - safety coordinate systems - Datum's and GPS - Receiver design - receiver architecture - dynamic range - frequency conversion and filtering - examples of practical receivers.

UNIT - V TRANSMISSION LINE EQUIPMENT 9

Digital microwave radio - fiber optic equipment - wire line equipment - cabling - grounding - Power battery backup - GPS antenna - reliability issues - cell site selection - microwave repeater site selection - microwave site and path survey - microwave antenna mounting - measurement of RF fields - source emissions - power level and radiation pattern - microwave installation measurements and testing.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : RF Integrated Circuit Design		**Course Code :** 20ECV32
CO	**Course Outcomes**	**K-CO**
C323.1	Design Low noise amplifier, power amplifier for portable applications.	K3
C323.2	Develop RF oscillator for high frequency applications	K3
C323.3	Recognize the fundamentals of RF integrated circuits operating at radio frequencies.	K2
C323.4	Apply RF technology in the high frequency IC design.	K3
C323.5	Choose the theoretical and practical design aspects in the microwave point to point system.	K3
C323.6	Apply IC design techniques in the transmission line equipment.	K3

TEXT BOOKS:

1. David Pozar, “Microwave and RF Design of Wireless Systems”, John Wiley, Second Edition, 2012.
2. Hooman Darabi, “Radio Frequency Integrated Circuits and Systems”, Cambridge University Press, First Edition, 2015.

REFERENCES:

1. John Rogers and Calvin Plett, “Radio Frequency Integrated Circuit Design”, Artech House, Second Edition, 2002.
2. John Kraus and Daniel Fleisch, “Electromagnetics with Applications”, McGraw Hill Education, Fifth Edition, 2017.
3. Thomas H. Lee, “The Design of CMOS Radio Frequency Integrated Circuits”, Cambridge University Press, Second Edition, 2003.
4. Sorin Voinigescu, “High Frequency Integrated Circuits”, Cambridge University press, First Edition, 2013.

20ECV33	DSP ARCHITECTURE AND PROGRAMMING	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To understand the basics on digital signal processors.
- To learn the programmable DSP's architecture, on-chip peripherals and instruction set.
- To learn the programming for signal processing applications.
- To learn the advanced programmable DSP processors.

PRE-REQUISITE:

Course Code: 20EC302, 20EC405
Course Name: Signals and Systems, Principles of Digital Signal Processing

UNIT - I FUNDAMENTALS OF PROGRAMMABLE DSPs **6**

Introduction to Programmable DSPs - Architectural Features of PDSPs - Multiplier and Multiplier accumulator - Modified Bus Structures and Memory access - Multiple access memory - Multi-port memory - VLIW architecture - Pipelining - Special Addressing modes in P-DSPs - On chip Peripherals - Applications of Programmable DSPs.

LAB COMPONENT

1. Demonstration of TMS320C5X processor.
2. Exploration of code composer studio. **6**

UNIT - II TMS320C5X PROCESSOR **6**

Architecture of C5X Processor - Addressing modes - Assembly language Instructions - Pipeline structure -on-chip Peripherals - Block Diagram of DSP starter kit (DSK) - Software Tools – DSK on-board peripherals.

LAB COMPONENT

3. Study the addressing modes of TMS320c5x processors.
4. Perform Linear convolution using TMS 320 c5x **6**

UNIT - III TMS320C6X PROCESSOR **6**

Architecture of the C6x Processor - Addressing modes - Assembler directives - on-chip peripherals - DSP Development System - DSP Starter Kit - Code Composer Studio (CCS) - Support Files. Real-Time Programming Examples for Signals and Noise generation, Frequency analysis

LAB COMPONENT

5. Real-Time Programming Examples for Signals and Noise generation, Frequency analysis **6**

UNIT - IV ADSP PROCESSORS **6**

Architecture of ADSP-21XX series of DSP processors- Addressing modes and assembly language instructions - Application programs - Fast Fourier Transform (FFT) calculation.

LAB COMPONENT

6. Implementation FFT algorithm (DIT & DIF) using ADSP processor. **6**

UNIT - V ADVANCED PROCESSORS **6**

Study of TI's advanced processor - TMS320C674x DSPs - ADSP's Blackfin and Sigma DSP Processors - NXP's DSP56Fxx Family of DSP Processors - Comparison of the features of TI, ADSP, NXP DSPs.

LAB COMPONENT

7. Implementation of simple linear and circular convolution using TMS320C674x DSPs. **6**

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : DSP Architecture and Programming		**Course Code :** 20ECV33
CO	**Course Outcomes**	**K-CO**
C334.1	Discuss the fundamental concepts of Digital signal processors.	K2
C334.2	Develop Assembly language program using TMS320C5X processor.	K3
C334.3	Use TMS320C6X processor and its instructions in the generation of signals and noise	K3
C334.4	Develop C Program using Code Composer Studio of DSP for the real time applications	K3
C334.5	Discuss the architecture, addressing modes and assembly language instructions of ADSP processors.	K2
C334.6	Analyze the suitable Advanced DSP Processors for real-time signal processing applications.	K3

TEXT BOOKS:

1. B.Venkataramani and M.Bhaskar, “Digital Signal Processors: Architecture, Programming and Applications”, Tata McGraw-Hill Publishing Company Limited, 2011.
2. Avtar Singh and S. Srinivasan, “Digital Signal Processing: Implementations using DSP Microprocessors with Examples from TMS320C54xx”, Cengage Learning India Private Limited, Delhi, 2012.

REFERENCES:

1. V. Udayashankara, “Modern Digital Signal Processing includes Signals and Systems, MATLAB programs, DSP architecture with Assembly and C programs”, PHI Publications, Third Edition, 2015.
2. Rulph Chassaing and Donald Reay, “Digital Signal Processing and Applications with the C6713 and C6416 DSK”, John Wiley & Sons, Inc. Publication, 2012 (Reprint).
3. User guides from Texas Instruments, Analog Devices and NXP.

20ECV34	FUNDAMENTALS OF SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about soft computing techniques and their applications.
- To analyze various neural network architectures.
- To understand perceptron and counter propagation networks.
- To understand the fuzzy systems.
- To analyze the genetic algorithms and their applications.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION TO SOFT COMPUTING 9

Introduction of soft computing and characteristics - learning methods - taxonomy - Evolution of neural networks - basic models - important technologies - applications. Fuzzy logic: Introduction, crisp sets, fuzzy sets. Crisp relations and fuzzy relations: Cartesian product of relation, classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets.

UNIT - II NEURAL NETWORKS 9

McCulloch-Pitts neuron - linear reparability - hebb network - supervised learning network - perceptron networks - adaptive linear neuron - multiple adaptive linear neuron - BPN - RBF - TDNN - associative memory network - auto-associative memory network - hetero-associative memory network - BAM - hopfield networks - iterative auto associative memory network - iterative associative memory network - unsupervised learning networks - Kohonen self-organizing feature maps - LVQ - CP networks - ART network.

UNIT - III FUZZY LOGIC 9

Fuzzy Sets - Properties - Membership functions - Fuzzy operations - Applications - Classification and Regression tree - Data clustering algorithms - Rule-based structure identification and Regression trees - neuro fuzzy systems.

UNIT - IV GENETIC ALGORITHM 9

Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts - operators - Encoding scheme - Fitness evaluation - crossover - mutation - genetic programming - multilevel optimization - real life problem- advances in GA.

UNIT - V HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS 9

Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, Optimization of traveling salesman problem using genetic algorithm approach, Soft computing based hybrid fuzzy controllers.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Fundamentals of Soft Computing		**Course Code :** 20ECV34
CO	**Course Outcomes**	**K-CO**
C335.1	Apply various soft computing concepts for practical applications.	K3
C335.2	Choose and design suitable neural networks for real time problems.	K3
C335.3	Use fuzzy rules and reasoning to develop decision making and expert system.	K3
C335.4	Explain the importance of optimization techniques and genetic programming.	K2
C335.5	Apply Genetic algorithms in multimedia application processing.	K3
C335.6	Summarize the various hybrid soft computing techniques and apply in real time problems.	K2

TEXT BOOKS:

1. S.N. Sivanandam and S.N. Deepa, “Principles of Soft Computing”, Wiley India Pvt., Ltd., 2011.
2. J.S.R. Jang, C.T. Sun and E. Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI/Pearson Education, 2004.

REFERENCES:

1. S. Rajasekaran and G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications”, Prentice-Hall of India Pvt. Ltd., 2006.
2. George J. Klir, Ute St. Clair and Bo Yuan, “Fuzzy Set Theory: Foundations and Applications”, Prentice Hall, 1997.
3. David E. Goldberg, “Genetic Algorithm in Search Optimization and Machine Learning”, Pearson Education India, 2013.
4. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Pearson Education India, 1991.
5. Simon Haykin, “Neural Networks Comprehensive Foundation” Second Edition, Pearson Education, 2005.

20ECV35	EMBEDDED PROCESSORS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- Provide understanding of architecture of MSP430 microcontroller
- Develop ability to write and Interpret C language programs for MSP430
- Use advance features in PWM for MSP430
- Interface various devices with MSP430
- Understand use of MSP 430 for IoT applications

PRE-REQUISITE:
Course Code: 20EC511
Course Name: Microprocessor and Microcontroller based systems

UNIT - I MSP430 ARCHITECTURE & PROGRAMMING **6**

Introduction to MSP430, RISC Architecture / Functional Block Diagram of MSP430, Pin Diagram, Memory Organization, CPU, On-Chip Peripherals. Overview of MSP430 Launch pad and its Features, GPIO programming and I/O multiplexing; Interrupts and interrupt programming

LAB COMPONENT

1. Study of functional Unit of MSP430 Launch pad.
2. Demonstration of Code Composer Studio and sample GPIO programming **6**

UNIT - II TIMERS, PWM CONTROL AND RTC **6**

Watchdog timer, Timers, Measurement in Capture Mode, PWM control – Edge-Aligned PWM, Centred PWM and Sine-PWM, Real Time Clock (RTC)

LAB COMPONENT

3. PWM generation using Timer on MSP430 GPIO.
4. PWM based Speed Control of Motor controlled by MSP430 GPIO. **6**

UNIT - III ADC AND OPERATING MODES **6**

Analog-to-Digital Conversion: General Issues, Successive Approximation. Basic Operation of ADC10, Advanced Operation of ADC10, ADC10 Successive Approximation, Digital to Analog Conversion, Low Power aspects of MSP430: Operating Modes, low power modes.

LAB COMPONENT

5. Interfacing ADC using MSP430
6. Interfacing DAC using MSP430 **6**

UNIT - IV COMMUNICATION PROTOCOLS **6**

Serial communication basics, USCI, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C), UART protocol, I2C protocol, SPI protocol, Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices.

LAB COMPONENT

7. I2C communication using MSP430.
8. UART communication using MSP430. **6**

UNIT - V IOT BASICS AND APPLICATIONS OF MSP430 **6**

IoT overview and architecture, Overview of wireless sensor networks and design examples. Various wireless connectivity: NFC, ZigBee and Bluetooth

LAB COMPONENT

9. Real world application: MSP430 based Embedded Networking Application: “Implementing Wi-Fi or Bluetooth Connectivity in a Smart Electric Meter” **6**

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Embedded Processors		**Course Code :** 20ECV35
CO	**Course Outcomes**	**K-CO**
C336.1	Explain architecture of MSP430 microcontroller, its instructions and the addressing modes	K2
C336.2	Develop and debug program in C language for specific applications.	K3
C336.3	Use the CCS software to operate the MSP430 GPIO using basic I/O operation.	K3
C336.4	Demonstrate the PWM techniques for control the external device using MSP430	K2
C336.5	Demonstrate the serial &wireless communication techniques using MSP430	K3
C336.6	Develop IoT based application using MSP430.	K3

TEXT BOOKS:

1. Getting Started with the MSP430 Launchpad by Adrian Fernandez, Dung Dang, Newnes, 2013.
2. MSP430 microcontroller basics 1st Edition by John H. Davies, Newnes - Elseveir, 2008.

REFERENCES:

1. MSP430 Microcontrollers in Embedded System Projects, C P RaviKumar, 1st Edition, Elite Publishing House, 2012.
2. Analog and Digital Circuits for Electronic Control System Applications: Using the TI MSP430 Microcontroller, Jerry Luecke, 1st Edition, Elsevier, 2005.
3. User Manual MSP430 from TI.com.

20ECV36 HUMAN ASSIST DEVICES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the role and importance of machines that takes over the functions of the heart and lungs.
- To study various mechanical techniques that helps a non-functioning heart.
- To learn the functioning of the unit which does the clearance of urea from the blood.
- To understand the tests to assess the hearing loss and development of electronic devices to compensate for the loss.
- To study about recent techniques used in modern clinical applications.

PRE-REQUISITE: NIL

UNIT - I HEART LUNG MACHINE AND ARTIFICIAL HEART 9

Condition to be satisfied by the H/L System. Different types of Oxygenators, Pumps, Pulsatile and Continuous Types, Monitoring Process, Shunting, The Indication for Cardiac Transplant, Driving Mechanism, Blood Handling System, Functioning and different types of Artificial Heart, Schematic for temporary bypass of left ventricle.

UNIT - II CARDIAC ASSIST DEVICES 9

Assisted through Respiration, Right and left Ventricular Bypass Pump, Auxiliary ventricle, Open Chest and Closed Chest type, Intra Aortic Balloon Pumping, Prosthetic Cardiac valves, Principle of External Counter pulsation techniques.

UNIT - III ARTIFICIAL KIDNEY 9

Indication and Principle of Haemodialysis, Membrane, Dialysate, types of filter and membranes, Different types of hemodialyzers, Monitoring Systems, Wearable Artificial Kidney, Implanting Type.

UNIT - IV RESPIRATORY AND HEARING AIDS 9

Ventilator and its types-Intermittent positive pressure, Breathing Apparatus Operating Sequence, Electronic IPPB unit with monitoring for all respiratory parameters. Types of Deafness, Hearing Aids, SISI, masking techniques, wearable devices for hearing correction.

UNIT - V RECENT TRENDS 9

Transcutaneous electrical nerve stimulator, bio-feedback, Diagnostic and point-of-care platforms.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Human Assist Devices		**Course Code :** 20ECV36
CO	**Course Outcomes**	**K-CO**
C337.1	Classify the transducers used for measurement of temperature, strain, motion, position and light.	K2
C337.2	Explain the construction and working of various industrial parameters and devices used to measure temperature.	K2
C337.3	Explain the construction and working of semiconductor magneto resistors and synchro resolvers.	K2
C337.4	Analyze the characteristics of photo resistors, fiber optic sensors and polarization of sensor electrodes.	K2
C337.5	Explain the function of primary sensors and standards for smart sensor interface.	K2
C337.6	Explain the Pneumatic and hydraulic actuation systems and functions of control valves.	K2

TEXT BOOKS:

1. R.S.Khandpur, “Handbook of Bio Medical Instrumentation”, Second Edition, Tata Mc Graw Hill, 2003.
2. Dr.M.Arumugam, “Bio Medical Instrumentation”, Anuradha Agencies, 2003.
3. Gray E. Wnek and Gray L. Browlin, “Encyclopedia of Biomaterials and Biomedical Engineering”, Marcel Dekker Inc., New York, 2004.

REFERENCES:

1. Andreas F. Von Recum, “Hand book of bio material evaluation”, McGraw-Hill Professional, 1986.
2. Gray E. Wnek and Gray L. Browlin, “Encyclopedia of Biomaterials and Biomedical Engineering”, Marcel Dekker Inc., New York, 2004.
3. D.S.Sunder, “Rehabilitation Medicine”, Third Edition, Jaypee Medical Publication, 2010.
4. Joseph D. Bronzino, “The Biomedical Engineering Handbook”, Third Edition: Three Volume Set, CRC Press, 2006.

20ECV41 VLSI TESTING AND DESIGN FOR TESTABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To involve the students in the theory and practice of VLSI test and validations.
- To introduce advanced techniques for efficiently testing and validating the VLSI design.
- To introduce the concept of Design for Test and the technique of automated test pattern generation.
- To define a methodology to test the combinational and sequential circuits.
- To construct a Design for Testability (DFT) algorithm for VLSI Circuits.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION TO TESTING 9

Introduction - VLSI Testing Process and Test Equipment – Challenges in VLSI Testing - Test Economics and Product Quality - Fault Modeling - Relationship among Fault Models.

UNIT – II LOGIC & FAULT SIMULATION & TESTABILITY MEASURES 9

Simulation for Design Verification and Test Evaluation - Modeling Circuits for Simulation - Algorithms for True Value and Fault Simulation - SCOAP Controllability and Observability.

UNIT – III TEST GENERATION FOR COMBINATIONAL AND SEQUENTIAL CIRCUITS 9

Algorithms and Representations - Redundancy Identification - Combinational ATPG Algorithms - Sequential ATPG Algorithms - Simulation Based ATPG - Genetic Algorithm Based ATPG.

UNIT – IV DESIGN FOR TESTABILITY 9

Design for Testability Basics - Testability Analysis - Scan Cell Designs - Scan Architecture – Built-in Self-Test - Random Logic BIST - DFT for other Test Objectives.

UNIT – V FAULT DIAGNOSIS 9

Introduction and Basic Definitions - Fault Models for Diagnosis - Generation for Vectors for Diagnosis - Combinational Logic Diagnosis - Scan Chain Diagnosis - Logic BIST Diagnosis.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : VLSI Testing And Design For Testability		**Course Code :** 20ECV41
CO	**Course Outcomes**	**K-CO**
C338.1	Explain the various VLSI Testing Process and challenges with fault modeling.	K2
C338.2	Construct Logic Simulation for modeling circuits.	K3
C338.3	Construct various Fault Simulation process with testability measures.	K3
C338.4	Develop Test generation for Combinational and Sequential circuits.	K3
C338.5	Apply the Design for Testability with scan cell designs and Built In Self-Test.	K3
C338.6	Explain various Fault Diagnosis methods.	K2

TEXT BOOKS:

1. Laung-Terng Wang, Cheng-Wen Wu and Xiaoqing Wen, “VLSI Test Principles and Architectures”, Elsevier, 2017.

REFERENCES:

1. Michael L. Bushnell and Vishwani D. Agrawal, “Essentials of Electronic Testing for Digital, Memory & Mixed-Signal VLSI Circuits”, Kluwer Academic Publishers, 2017.
2. Niraj K. Jha and Sandeep Gupta, “Testing of Digital Systems”, Cambridge University Press, 2017.
3. Vishwani Agrawal and Michael Bushnell, “Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits”, Springer, 2002.
4. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, “Digital Integrated Circuits: A Design perspective”, Pearson, Second Edition, 2016.

20ECV42	WIRELESS BROADBAND NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the various network layer and transport layer protocols for wireless networks.
- To study the architecture in 3G standards.
- To learn about 4G technologies and LTE-A in mobile cellular network.
- To learn about the layer level functionalities in interconnecting networks.
- To study the emerging techniques in 5G network.

PRE-REQUISITE: NIL

UNIT - I WIRELESS PROTOCOLS 9

Mobile Network Layer **-** Fundamentals of Mobile IP - IP packet Delivery - IPv6 - IP Micro Mobility - IP Addressing - DHCP-Mobile Transport Layer - Traditional TCP - Congestion Control, Slow Start, Fast recovery/Fast retransmit - classical TCP improvements - Indirect TCP - snooping TCP, Mobile TCP.

UNIT - II 3G EVOLUTION 9

IMT-2000 - W-CDMA, CDMA 2000 - radio & network components, network structure, packet-data transport process flow, core network, UMTS-services, air interface, network architecture of 3GPP, UTRAN - architecture, High Speed Packet Data-High Speed Downlink packet access (HSDPA) High Speed Uplink packet access (HSUPA).

UNIT - III 4G EVOLUTION 9

Introduction to LTE-A - Requirements and Challenges, network architectures - EPC, E-UTRAN architecture - mobility management, resource management, services, downlink/uplink data transfer, PDU packet formats, scheduling services, random access procedure.

UNIT - IV LAYER-LEVEL FUNCTIONS 9

Characteristics of wireless channels - downlink physical layer, uplink physical layer, MAC scheme - frame structure, resource structure, mapping, SC-FDMA, interference cancellation - CoMP, Carrier aggregation, Services - multimedia broadcast/multicast, location-based services.

UNIT - V 5G EVOLUTION 9

5G Roadmap - Pillars of 5G - 5G Architecture, The 5G internet - IoT and context awareness - Networking reconfiguration and virtualization support - Mobility QoS control - Small cells for 5G mobile networks- capacity limits and achievable gains with densification - Mobile data demand, Demand Vs Capacity, Small cell challenges, conclusion and future directions.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Wireless Broad Band Networks		**Course Code :** 20ECV42
CO	**Course Outcomes**	**K-CO**
C339.1	Design and implement the various protocols in wireless Networks.	K3
C339.2	Analyze the architecture of 3G network standards.	K4
C339.3	Analyze the difference of LTE-A network design from 4G Standard.	K4
C339.4	Design the interconnecting network functionalities by layer level functions.	K3
C339.5	Explore the current generation (5G) network architecture.	K3
C339.6	Analyze the QoS requirements of 5G networks under the massive wireless data traffic from different application scenarios.	K4

TEXT BOOKS:

1. Jochen Schiller, “Mobile Communication”, Second Edition, Pearson Edition, 2008.
2. P.E.Clint Smith and Dannel Collins, “3G Wireless Networks”, Second Edition, Tata McGraw-Hill, 2011.

REFERENCES:

1. Vijay K.Garg, “Wireless Network Evolution - 2G & 3G”,. Prentice Hall, 2008.
2. Sassan Ahmadi, “LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies”, Elsevier, 2014.
3. Jonathan Rodriguez, "Fundamentals of 5G Mobile networks", John Wiley, 2015.

20ECV43	TEXT AND SPEECH ANALYSIS	L	T	P	C
		2	0	2	3

OBJECTIVES:

- Understand natural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

PRE-REQUISITE:

Course Code: 20GE101
Course Name: Problem Solving using Python Programming

UNIT - I NATURAL LANGUAGE BASICS **6**

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model.

LAB COMPONENT **6**

1. Create Regular expressions in Python for detecting word patterns and tokenizing text.
2. Getting started with Python and NLTK - Searching Text, Counting Vocabulary, Frequency Distribution, Collocations, Bigrams.

UNIT - II TEXT CLASSIFICATION **6**

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models.

LAB COMPONENT **6**

3. Accessing Text Corpora using NLTK in Python.
4. Write a function that finds the 50 most frequently occurring words of a text that are not stopwords.
5. Implement the Word2Vec model.
6. Use a transformer for implementing classification.

UNIT - III QUESTION ANSWERING AND DIALOGUE SYSTEMS **6**

Information retrieval – IR-based question answering – knowledge-based question answering - language models for QA – classic QA models – chatbots – Design of dialogue systems - evaluating dialogue systems.

LAB COMPONENT **6**

7. Design a chatbot with a simple dialogue system.

UNIT - IV TEXT-TO-SPEECH SYNTHESIS **6**

Overview – Text normalization - Letter-to-sound - Prosody, Evaluation, Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems.

LAB COMPONENT **6**

8. Convert text to speech and find accuracy.

UNIT - V AUTOMATIC SPEECH RECOGNITION **6**

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems.

LAB COMPONENT **6**

9. Design a speech recognition system and find the error rate.

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Text And Speech Analysis		**Course Code :** 20ECV43
CO	**Course Outcomes**	**K-CO**
C340.1	Model Language using Text preprocessing, tokenization and representation using N-Gram.	K3
C340.2	Apply deep learning techniques for NLP tasks, language modelling and machine translation	K3
C340.3	Make use of word2vec and transformers for text classification.	K3
C340.4	Build question-answering systems, chatbots and dialogue systems	K3
C340.5	Design a chatbot with a simple dialogue system.	K3
C340.6	Apply deep learning models for building speech recognition and text-to-speech systems.	K3
C340.7	Use HMM and HMM-DNN systems for feature extraction in Acoustic model.	K3
C340.8	Design a speech recognition system.	K3

TEXT BOOKS:

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Third Edition, 2022.
2. Christopher Manning and Hinrich Schutze, “Foundations of Statistical Natural Language Processing”, MIT Press, 1999.

REFERENCES:

1. Dipanjan Sarkar, “Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data”, APress, 2018.
2. Tanveer Siddiqui, Tiwary U S, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, “Fundamentals of Speech Recognition” 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, “Natural language processing with Python”, O’REILLY.

20ECV44 **DEEP LEARNING**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic ideas and principles of neural networks.
- To understand the basic concepts of big data and statistical data analysis.
- To familiarize the student with the image processing facilities like tensorflow and keras.
- To learn to use deep learning tools and framework for solving real-life problems.
- To use Python for deep learning.

Pre-requisite: - NIL -

UNIT - I INTRODUCTION TO NEURAL NETWORKS 9

Basic concept of Neurons – Perceptron Algorithm – Feed Forward and Back Propagation Networks.

UNIT - II INTRODUCTION TO DEEP LEARNING 9

Feed Forward Neural Networks – Gradient Descent – Back Propagation Algorithm – Vanishing Gradient problem – Mitigation – RelU Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Nestors Accelerated Gradient Descent – Regularization – Dropout.

UNIT - III CONVOLUTIONAL NETWORKS 9

Convolution operation – Motivation – Pooling – Convolution and Pooling as strong prior – Efficient convolution algorithms – Unsupervised features – Sequence Modeling: Recurrent and Recursive Nets – LSTM Networks – Applications – Computer Vision – Speech Recognition – Natural Language Processing.

UNIT - IV DEEP LEARNING ARCHITECTURES 9

LSTM, GRU, Encoder/Decoder Architectures – Autoencoders – Standard- Sparse – Denoising – Contractive - Variational Autoencoders – Adversarial Generative Networks – Autoencoder and DBM.

UNIT - V DEEP LEARNING WITH PYTHON 9

Introduction to Keras and Tensorflow – Deep Learning for computer vision – convnets – Deep Learning for Text and Sequences – Generative Deep Learning – Text Generation with LSTM – Deep Dream – Neural Style Transfer – Generating images with variational autoencoders – Generative Adversarial Networks (GAN).

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Deep Learning		**Course Code :** 20ECV44
CO	**Course Outcomes**	**K-CO**
C341.1	Explain the basic concepts of neural network.	K2
C341.2	Identify the deep learning algorithms for various domains	K2
C341.3	Explain about basics of Convolutional Neural Networks.	K3
C341.4	Apply appropriate deep learning models for analyzing the data.	K3
C341.5	Illustrate the concept of Tensor Flow/Keras in deep learning	K2
C341.6	Develop an application using deep learning techniques	K3

TEXT BOOKS:

1. Ian Goodfellow, Yoshua Bengio and Aaron Courville, “Deep Learning”, The MIT Press, 2016.
2. Nikhil Buduma and Nicholas Lacascio, “Fundamentals of Deep Learning”, O.Reilly, First Edition, 2017.

REFERENCES:

1. Josh Patterson and Adam Gibson, “Deep Learning: A Practitioner's Approach”, O'Reilly Media, 2017.
2. Laura Graesser and Wah Loon Keng, “Foundations of Deep Reinforcement Learning: Theory and Practice in Python”, Addison-Wesley Professional, 2020.
3. Francois Chollet, “Deep Learning with Python”, Manning Publications, 2018.
4. Jon Krohn, Grant Beyleveld and Aglaé Bassens, “Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence”, Addison-Wesley Professional, First Edition, 2019.
5. Navin Kumar Manaswi, “Deep Learning with Applications Using Python”, Apress, 2018.

20ECV45 ROBOTICS AND AUTOMATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study the various kinematics and robot dynamics.
- To study the trajectory planning and control for robot.
- To study the control of robots for some specific applications.

PRE-REQUISITE: NIL

UNIT - I BASIC CONCEPTS OF ROBOTS 9

Introduction of robots – Classification of robots – Present status and future trends – Basic components of robotic system – Mechanisms and transmission – End effectors – Grippers – different methods of gripping – Specifications of robot.

UNIT - II DRIVE SYSTEMS AND SENSORS 9

Drive system – hydraulic, pneumatic and electric systems – Sensors in robot: Touch sensors, Tactile sensor, Proximity and range sensors, Robotic vision sensor, Force sensor, Light sensors, Pressure sensors.

UNIT - III KINEMATICS AND DYNAMICS OF ROBOTS 9

2D & 3D Transformation – Scaling – Rotation – Translation – Homogeneous coordinates – multiple transformation – Simple problems – Matrix representation – Forward and Reverse Kinematics of Three Degree of Freedom – Homogeneous Transformations – Inverse kinematics of Robot – Robot Arm dynamics – Basics of Trajectory Planning.

UNIT - IV ROBOT CONTROL 9

Robot controls – Point to point control – Continuous path control – Intelligent robot – Control system for robot joint – Control actions – Feedback devices – Encoder – Resolver – LVDT – Motion Interpolations – Adaptive control.

UNIT - V ARTIFICIAL INTELLIGENCE IN ROBOTICS 9

Application of Machine learning – Artificial Intelligence – Expert systems – Tele-robotics and Virtual Reality – Micro and Nanorobots – Unmanned vehicles – Cognitive robotics – Evolutionary robotics – Humanoids.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Robotics and Automation		**Course Code :** 20ECV45
CO	**Course Outcomes**	**K-CO**
C342.1	Explain the basic concepts of robotics.	K2
C342.2	Classify the various sensors used in robotics.	K3
C342.3	Explain about the differential kinematic in robotics.	K2
C342.4	Classify the various dynamics in robotics.	K3
C342.5	Discuss the different controls of robot.	K2
C342.6	Apply Artificial Intelligence in the field of robotics.	K3

TEXT BOOKS:

1. Mikell P. Groover, Nicholas G. Odrey, Mitchel Weiss, Roger N. Nagel and Ashish Dutta, “Industrial Robotics, Technology programming and Applications”, McGraw Hill, 2017.
2. J.J.Craig, “Introduction to Robotics - mechanics and control”, Addison-Wesley, Fourth Edition, 2008.

REFERENCES:

1. S.R.Deb, “Robotics Technology and flexible automation”, Tata McGraw-Hill Education, 2009.
2. Richard D. Klafter, A.Thomas, Chri Elewski and Michael Negin, “Robotics Engineering an Integrated Approach”, PHI Learning, 2009.

20ECV46	WIRELESS BODY AREA NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the support system of WBAN.
- To get knowledge about the various protocol design.
- To understand the power management of WBAN.
- To know the application of WBAN in medical field.
- To understand the various wearable applications of WBAN.

PRE-REQUISITE: NIL

UNIT - I OVERVIEW AND SUPPORT SYSTEMS OF WBAN 9

Introduction – WBAN – Hardware: Wireless body sensors – Sensor nodes and hardware designs – Wireless systems and platforms – Wireless transceivers and microcontrollers – Existing sensor boards – Design of implanted sensor nodes for WBAN – WBAN Systems – Software programs and monitoring.

UNIT - II PROTOCOL DESIGN FOR WBAN 9

Network topologies and configuration – Basics of MAC protocol – Traffic characteristics – Scheduled protocol – Random access protocol – Hybrid MAC protocol – Energy management in WBAN – Patient Monitoring Network Design – Performance analysis of WBAN.

UNIT - III POWER MANAGEMENT 9

The Case for Transmit Power Control in Body Area Networks: Normal Walk, Slow Walk, Resting, Optimal Off-Line Transmit Power Control, Practical On-Line. Transmit Power Control: A Simple and Flexible Class of Schemes. Example: Adaptations of the General Scheme, Tuning the Parameters.

UNIT - IV APPLICATIONS OF WBAN IN MEDICAL 9

Monitoring patients with chronic disease – Hospital patients – Elderly patients – Cardiac arrhymias monitoring – Multi patient monitoring systems – Multichannel Neural recording – Gait analysis – Sports Medicine – Electronic pill.

UNIT - V WEARABLE SYSTEMS 9

Need for Wearable Systems – Applications of Wearable Systems – Recent developments – Global and Indian Scenario – Types of Wearable Systems – Components of wearable Systems – Physiological Parameters commonly monitored in wearable applications – Smart textiles & textiles sensors – Wearable Systems for Disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Wireless Body Area Networks		**Course Code :** 20ECV46
CO	**Course Outcomes**	**K-CO**
C343.1	Explain the support system of wireless body area network.	K2
C343.2	Develop network protocols for wireless body area network.	K3
C343.3	Explain the power management systems in wireless body area networks.	K2
C343.4	Apply the concepts of Wireless body area network in medical field.	K3
C343.5	Explain the fundamentals of wearable systems.	K2
C343.6	Classify different types of Wearable systems.	K3

TEXT BOOKS:

1. Huan-Bang Li and Kamya Yekeh Yazdandoost Bin-Zhen, “Wireless Body Area Networks”, River Publishers, 2010.
2. Mehmet R. Yuce and Jamil Y. Khan, “Wireless Body Area Networks Technology, Implementation, and Applications”, Pan Stanford Publishing Pte. Ltd, Singapore, 2012.

REFERENCES:

1. Annalisa Bonfiglio and Danilo De Rossi, “Wearable Monitoring Systems”, Springer, 2011.
2. Terrance J. Dishongh and Michael Mcgrath, “Wireless Sensor Networks for Healthcare Applications”, Artech House, First Edition, 2009.
3. Guang-Zhong Yang and M.Yacoub, “Body Sensor Networks”, Springer, First Edition, 2006.
4. Huan-Bang Li, Kamya Yekeh Yazdandoost and Bin Zhen, “Wireless Body Area Network”, River Publishers’ Series in Information Science and Technology, 2010.

20ECV51	LOW POWER IC DESIGN	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To learn the fundamentals of low power low voltage VLSI design.
- To understand the impact of power on system performances.
- To understand the different design approaches.
- To develop the low power low voltage memories

PRE-REQUISITE:

Course Code: 20EC505

Course Name: Digital VLSI Design and FPGA Implementation

UNIT I FUNDAMENTALS OF LOW POWER CIRCUITS 6

Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation, Short Channel Effects – Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

LAB COMPONENT 1. Modeling and sources of power consumption **6**

UNIT II LOW-POWER DESIGN APPROACHES 6

Low-Power Design through Voltage Scaling: VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches. Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, Mask level Measures.

LAB COMPONENT 2. Power estimation at different design levels (mainly circuit, transistor, and gate) **6**

UNITIII LOW-VOLTAGE LOW-POWER ADDERS 6

Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, Low Voltage Low Power Design Techniques –Trends of Technology and Power Supply Voltage, Low Voltage Low-Power Logic Styles.

LAB COMPONENT 3. Power optimization for combinational circuits **6**

UNIT IV LOW-VOLTAGE LOW-POWER MULTIPLIERS 6

Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier

LAB COMPONENT 4. Power optimization for sequential circuits **6**

UNIT V LOW-VOLTAGE LOW-POWER MEMORIES 6

Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Pre-charge and Equalization Circuit, Low Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

LAB COMPONENT 5. Power optimization for RT and algorithmic levels **6**

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Wireless Body Area Networks		**Course Code :** 20ECV51
CO	**Course Outcomes**	**K-CO**
C344.1	Summarize the sources of power dissipation.	K2
C344.2	Discuss different low-power design approaches.	K2
C344.3	Design low-voltage low-power adder logic circuits.	K3
C344.4	Design low-voltage low-power multiplier logic circuits.	K3
C344.5	Design low-voltage low-power memory logic circuits.	K3
C344.6	Design and develop low power, low voltage circuits.	K3

TEXT BOOKS:

1. Sung-Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated Circuits – Analysis and Design”, TMH, 2011.
2. 2. Kiat-Seng Yeo, Kaushik Roy, “Low-Voltage, Low-Power VLSI Subsystems”, TMH Professional Engineering, 2004.

REFERENCES:

1. Ming-BO Lin, “Introduction to VLSI Systems: A Logic, Circuit and System Perspective”, CRC Press, 2012.
2. Anantha Chandrakasan, “Low Power CMOS Design”, IEEE Press, /Wiley International, 1998.
3. Kaushik Roy, Sharat C. Prasad, “Low Power CMOS VLSI Circuit Design”, John Wiley, & Sons, 2000.
4. Gary K. Yeap, “Practical Low Power Digital VLSI Design”, Kluwer Academic Press, 2002.
5. Bellamour, M. I. Elamasri, “Low Power CMOS VLSI Circuit Design”, A Kluwer Academic Press, 1995.
6. Siva G. Narendran, Anatha Chandrakasan, “Leakage in Nanometer CMOS Technologies”, Springer, 2005.

20ECV52 ADVANCED WIRELESS COMMUNICATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the various channel models.
- To know the channel capacity of fading channels.
- To understand the concepts of diversity combining techniques for transmit and receive diversity.
- To understand the MIMO communication architecture and beamforming.
- To understand the various multiple access techniques for multiuser.

PRE-REQUISITE: NIL

UNIT - I WIRELESS CHANNEL PROPAGATION AND MODEL 9

Propagation of EM signals in wireless channel – Reflection, diffraction and Scattering- free space, two ray. Small scale fading - channel classification - channel models – COST - 231 Hata model, Longley-Rice Model, NLOS Multipath Fading Models: Rayleigh, Rician, Nakagami, Composite Fading – shadowing Distributions, Link power budget Analysis.

UNIT - II CAPACITY OF WIRELESS CHANNELS 9

Capacity in AWGN, capacity of flat fading channel, capacity of frequency selective fading channels.

UNIT - III DIVERSITY 9

Realization of independent fading paths, Receiver Diversity: Selection combining, Threshold Combining, Maximum-ratio Combining, Equal Gain Combining. Transmitter Diversity: Channel known at transmitter, Channel unknown at the transmitter.

UNIT - IV MIMO COMMUNICATIONS 9

Narrowband MIMO model, Parallel decomposition of the MIMO channel, MIMO channel capacity, MIMO Diversity Gain: Beam forming, Diversity-Multiplexing trade-offs, Space time Modulation and coding: STBC, STTC, Spatial Multiplexing and BLAST Architectures.

UNIT - V MULTIUSER SYSTEMS 9

Review of Multiple Access Techniques, Scheduling, power control, Uplink and Downlink.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Advance Wireless Communication		**Course Code :** 20ECV52
CO	**Course Outcomes**	**K-CO**
C345.1	Identify appropriate wireless channel models using the wireless channel characteristics.	K3
C345.2	Apply the mathematics behind the capacity calculation under different channel conditions.	K3
C345.3	Selection of minimum fading path using diversity combining methods and the knowledge of channel.	K3
C345.4	Apply the diversity and beam forming concepts in MIMO Communications.	K3
C345.5	Classification of multiple access techniques	K3
C345.6	Make use of multiple access techniques in different multi-user scenarios.	K3

TEXT BOOKS:

1. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2007.
2. Harry R. Anderson, “Fixed Broadband Wireless System Design”, John Wiley, India, 2003.

REFERENCES:

1. Andreas F. Molisch, “Wireless Communications”, John Wiley, India, 2006.
2. Simon Haykin and Michael Moher, “Modern Wireless Communications”, Pearson Education, 2007.
3. T.S.Rappaport, “Wireless Communications”, Pearson Education, 2003.
4. Gordon L. Stuber, “Principles of Mobile Communication”, Springer International Ltd., 2001.
5. Upena Dalal, “Wireless Communication”, Oxford Higher Education, 2009.
6. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.

20ECV53 DIGITAL IMAGING AND COMPUTER VISION

L	T	P	C
2	0	2	3

OBJECTIVES:

- To become familiar with digital image fundamentals.
- To get exposed to simple image enhancement techniques in spatial and frequency domain.
- To learn concepts of degradation function and Image compression techniques.
- To study the image segmentation and morphological image processing.
- To become familiar with computer vision techniques.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION **6**

Components of Image Processing System - Image Sampling and Quantization - Some basic relationships - Neighbors - Connectivity - Distance Measures between pixels.

LAB COMPONENT

1. Write a MATLAB program for sampling and quantization.
2. Write a MATLAB program for relation between neighboring pixels and distance measurement. **6**

UNIT - II IMAGE ENHANCEMENT IN THE SPATIAL AND FREQUENCY DOMAIN **6**

Image enhancement by point processing and neighbourhood processing - Basic Gray Level Transformations - Histogram Processing - Basics of Spatial Filters - Smoothening and Sharpening - Spatial Filters Enhancement - Frequency Domain Filtering: Smoothing and Sharpening, Homomorphic Filtering.

LAB COMPONENT

3. Write a MATLAB program for basic gray level transformations.
4. Write a MATLAB program for filtering operations **6**

UNIT - III IMAGE RESTORATION AND IMAGE COMPRESSION **6**

Image Restoration: Model of the Image Degradation - Noise Models - Restoration in the presence of Noise Only Spatial Filtering - Inverse filtering - Wiener filtering.

Image Compression: Data Redundancies - Image Compression models - Lossless and Lossy compression - Huffman Coding - Shanon-Fano Coding

LAB COMPONENT

5. Write a MATLAB program for removing various noise in degraded images.
6. Implement MATLAB program for any one of the image compression techniques. **6**

UNIT - IV IMAGE SEGMENTATION AND MORPHOLOGICAL IMAGE PROCESSING **6**

Image Segmentation: Discontinuity based segmentation - similarity based segmentation - Edge linking and boundary detection - Threshold - Region based Segmentation.

Morphological Image Processing: Dilation - Erosion - Some basic Morphological Algorithms.

LAB COMPONENT

7. Write a MATLAB program for region-based image segmentation algorithm.
8. Implement MATLAB program for basic morphological operations. **6**

UNIT - V COMPUTER VISION TECHNIQUES **6**

Introduction to Computer vision - Image Formation: Geometric image formation - Feature extraction and detection - Matching - Object detection and tracking - Motion estimation - Object Modeling - video processing.

LAB COMPONENT

9. Write a MATLAB program for object tracking in videos.
10. Implement MATLAB program for feature extraction and detection in images. **6**

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Digital Imaging and Computer Vision		**Course Code :** 20ECV53
CO	**Course Outcomes**	**K-CO**
C346.1	Discuss how digital images are acquired, stored and relationship between pixels.	K2
C346.2	Illustrate image enhancement techniques in spatial and frequency domain.	K3
C346.3	Elaborate the mathematical modelling of image restoration and compression.	K4
C346.4	Describe the various image segmentation techniques.	K2
C346.5	Illustrate the morphological image processing and algorithms.	K3
C346.6	Discuss the fundamental concepts of Computer vision methods.	K2

TEXT BOOKS:

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Pearson Education, Fourth Edition, 2018.
2. David A. Forsyth and Jean Ponce, “Computer Vision: A Modern Approach”, Prentice Hall, 2015.

REFERENCES:

1. Anil K. Jain, “Fundamental of Digital Image Processing”, Prentice-Hall of India Pvt. Ltd., 2015.
2. W.K. Pratt, “Digital Image Processing”, A John Wiley & Sons Inc., 2007.
3. John C. Russ and F. Brent Neal, “The Image processing Handbook”, CRC Press, Seventh Edition, 2017.
4. Wesley E. Snyder and Hairong Qi, “Fundamentals of Computer Vision”, Cambridge University Press, First Edition, 2017.
5. Chris Solomon and Toy Breckon, “Fundamentals of Digital Image Processing: A practical approach with examples in Matlab”, Wiley Publication, First Edition, 2010.

20ECV54	DATA ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts of data analytic.
- To handle missing data in the real world data sets by choosing appropriate methods.
- To learn data analysis methods.
- To learn stream computing.
- To understand and apply data analysis techniques.
- To gain knowledge on Hadoop related tools.

PRE-REQUISITE:

Course Code: 20ECV14

Course Name: Machine Learning and Applications

UNIT - I INTRODUCTION **9**

Knowledge domains of Data Analysis – Understanding structured and unstructured data – data analytic tools – applications of data analytics – various phases of data analytics lifecycle: discovery, data preparation, model planning, model building, communicating results, operationalization.

UNIT - II DATA PREPROCESSING **9**

Data Preprocessing: Data Cleaning – Data Integration – Data Reduction – Data Transformation. Handling Missing Data: Introduction to Missing data – Traditional methods for dealing with missing data. Maximum Likelihood Estimation – Basics, Missing data handling, improving the accuracy of analysis.

UNIT - III CLASSIFICATION AND CLUSTERING **9**

Statistical Methods: Regression modelling – Multivariate Analysis – Classification: SVM & Kernel Methods – Rule Mining – Cluster Analysis – Types of Data in Cluster Analysis – Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Model Based Clustering Methods – Clustering High Dimensional Data – Predictive Analytics.

UNIT - IV INTELLIGENT DATA ANALYSIS **9**

Analysis of Time Series: Linear and Non Linear Systems Analysis, Neural Networks : Fundamentals – Back Propagation Neural Network – Fuzzy Logic : Basics of Fuzzy Sets and Fuzzy Logic - Genetic Algorithms

UNIT - V HADOOP FRAMEWORKS **9**

HADOOP: HDFS concepts, Algorithms using MapReduce. Introduction to NoSQL, Cassandra, Pig – Hive.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Digital Imaging and Computer Vision		**Course Code :** 20ECV54
CO	**Course Outcomes**	**K-CO**
C347.1	Explain the basic concepts of Data Analytic	K2
C347.2	Describe the Data Analysis preprocessing Techniques.	K3
C347.3	Explain about how missing data will be handled during preprocessing	K4
C347.4	Apply the Classification and Clustering algorithms for real time applications	K2
C347.5	Apply intelligent analytics techniques like neural networks, fuzzy and genetic algorithms for real time analytics applications	K3
C347.6	Explain the Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics	K2

TEXT BOOKS:

1. EMC Education Services (Editor), “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, John Wiley & Sons, 2015.
2. Craig K. Enders, “Applied Missing Data Analysis”, The Guilford Press, 2010.
3. Michael Berthold and David J. Hand, “Intelligent Data Analysis”, Springer, Second Edition, 2007.

REFERENCES:

1. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, Wiley, 2012.
2. Michael Minelli, Michelle Chambers and Ambiga Dhiraj, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses”, Wiley, 2013.
3. P.J. Sadalage and M. Fowler, “NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence”, Addison-Wesley Professional, 2012.

20ECV55	INDUSTRIAL IOT AND INDUSTRY 4.0	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To know about IoT Nodes & Sensors, IoT Gateways, IoT Cloud Systems and IoT Cloud Dashboards
- To study the challenges in IoT system Design – Hardware & Software

PRE-REQUISITE: - NIL

UNIT - I UNDERSTANDING IOT CONCEPT AND DEVELOPMENT PLATFORM 6

IOT Definition, Importance of IoT, Applications of IOT, IoT architecture, Understanding working of Sensors, Actuators, Sensor calibration, Study of Different sensors and their characteristics.

LAB COMPONENT

1. Interfacing LDR sensor, IR sensor.
2. Interfacing Temperature sensor, Gas sensor. **6**

UNIT - II ANALYZING & DECODING OF COMMUNICATION PROTOCOL USED IN IOT DEVELOPMENT PLATFORM 6

UART Communication Protocol, I2C Protocol device interfacing and decoding of signal, SPI Protocol device interfacing and decoding of signal, WIFI and Router interfacing, Ethernet Configuration, Bluetooth study and analysis of data flow, Zigbee Interfacing and study of signal flow.

LAB COMPONENT

3. Interfacing UART, I2C.
4. Interfacing Bluetooth, Zigbee. **6**

UNIT - III RSAPBERRY PI - IOT DEVELOPMENT PLATFORM 6

Raspberry Pi: Introduction to Raspberry Pi, About the Raspberry Pi Board: Hardware Layout and Pinouts, Operating Systems on Raspberry Pi, Configuring Raspberry Pi, Connecting Raspberry Pi via SSH, Remote access tools, Programming Raspberry Pi - Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins. Pi as Webserver, Pi Camera, Image & Video Processing using Pi.

LAB COMPONENT

5. Write a program using sensors for car parking assist.
6. Write a program using sensors for water level indicator and overflow detection. **6**

UNIT - IV IOT PHYSICAL DEVICES AND ENDPOINTS AND CONTROLLING HARDWARE AND SENSORS 6

Controlling Hardware - Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors;

Sensors - Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor.

LAB COMPONENT

7. Write a program to control LEDs using Alexa Echo Dot.
8. Write a program to control Buzzer using Alexa Echo Dot. **6**

UNIT - V CLOUD SERVICES USED IN IOT DEVELOPMENT PLATFORM 6

Configuration of the cloud platform, Sending data from the IOT nodes to the gateways using different communication options; Transferring data from gateway to the cloud; Exploring the web services like mail, Messaging (SMS) and Twitter etc.; Tracking of cloud data as per the requirement; Google Cloud service architect; AWS cloud Services architect; Microsoft Azure

cloud services Architect; OEN source Cloud Services; Initial State Iot Dashboard & Cloud Services.

LAB COMPONENT

9. Write a program to control Stepper motor using Google Assistance.
10. Write a program to control DC motor using Google Assistance. **6**

TOTAL: 60 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Industrial IOT And Industry 4.0		**Course Code :** 20ECV55
CO	**Course Outcomes**	**K-CO**
C348.1	Explain the building blocks of IoT technology and explore the vast spectrum of IoT applications.	K2
C348.2	Illustrate the processors and peripherals to design and build IoT hardware.	K3
C348.3	Illustrate the assess, select and customize technologies for IoT applications.	K3
C348.4	Apply connect numerous IOT applications with the physical world of humans and real life problem solving.	K3
C348.5	Design and implement IOT applications that manage big data.	K3
C348.6	Identify any societal problem and solve by applying the acquired knowledge in Industrial IoT and Industry 4.0.	K3

TEXT BOOKS:

1. Arshdeep Bahga and Vijay Madisetti, “Internet of Things – A Hands-on Approach”, Universities Press, 2015.
2. Matt Richardson and Shawn Wallace, “Getting Started with Raspberry Pi”, O’Reilly (SPD), 2014.

REFERENCES:

1. Simon Monk, “Raspberry Pi Cookbook: Software and Hardware Problems and solutions”, O’Reilly (SPD), 2016.
2. N.Ida, “Sensors, Actuators and Their Interfaces”, SciTech Publishers, 2014.
3. Peter Waher, “Learning Internet of Things”, Packt Publishing, 2015.

20ECV56	BIOMEDICAL IMAGING SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- A study of the principles and design of medical imaging systems such as X-ray, ultrasound, nuclear medicine, and nuclear magnetic resonance.
- The rapidly growing field of biomedical imaging enables one to visualize physiological structures.
- Provide an overview of physical processes of imaging biological tissues.
- Provide the students with mathematical and computational tools to analyse and interpret a range of biomedical images.

Pre-requisite:
Course Code: 20ECV53
Course Name: Digital Imaging and Computer Vision

UNIT - I FUNDAMENTALS OF MEDICAL IMAGING SYSTEMS 9

Medical imaging with x-rays: CT, MRI and ultrasound – X-ray radiography – ultrasound – radionuclide imaging – magnetic resonance imaging (MRI) – Biological effects of each modality – Topographical reconstruction principles – including X-ray computed tomography (CT) – position emission tomography (PET) – single-photon emission computed tomography (SPECT).

UNIT - II X-RAY IMAGING 9

The EM spectrum – interactions of EM radiation with tissue – ionizing radiation – x-ray production – photo electric effect – Compton scatter – X-ray imaging – Planar imaging: characterizing x-ray beams, Beer's law, linear attenuation coefficients, radiation dose, filtering and collimation, projection radiography, blurring and resolution, SNR. Basic concepts, evolution of x-ray CT scanners, hardware. CT measurement, CT numbers, line integrals and Radon transform. Projection slice theorem. Image reconstruction by filtered backprXojection for parallel and fan beam data. Conbeam CT. Sampling issues; resolution and noise in CT, beam hardening and scatter.

UNIT - III NUCLEAR MEDICINE 9

Radioactive decay and radioisotopes. Types of radioactive decay, gamma rays and positrons. Common sources in nuclear medicine. Radio pharmacy and kinetic modeling. The Anger camera and planar imaging. Collimators and imaging equations. Resolution and SNR. SPECT imaging basics, imaging equation, reconstruction. Resolution and noise properties. Quantitation: scatter, background, sensitivity. PET imaging basics, imaging equation, reconstruction. Resolution and noise properties.

UNIT - IV ULTRASOUND IMAGING 9

Wave equation, reflections and refractions, attenuation and absorption. Ultrasound transducer design, A, M and B mode display. Imaging signal model for pulse echo imaging, Image formation, and resolution and noise characteristics.

UNIT - V MAGNETIC RESONANCE IMAGING 9

MR hardware, spin physics, Bloch equations, Signal detection, spectroscopy, noise, RF excitation, Spin echoes, relaxation, contrast. Spatial encoding, image reconstruction, resolution, Artefacts, fMRI, diffusion MRI.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Biomedical Imaging Systems		**Course Code :** 20ECV56
CO	**Course Outcomes**	**K-CO**
C349.1	Describe how biomedical imaging systems are used in biological and medical research.	K2
C349.2	Analyze the x ray imaging systems used for needed biomedical applications.	K4
C349.3	Explain about Nuclear medicine used in SPECT and PET imaging basics.	K2
C349.4	Discuss the concept of the Anger camera and planar imaging.	K2
C349.5	Explain the fundamentals of ultrasound imaging and also ultrasound transducer design.	K2
C349.6	Illustrate the types and basis of MRI systems.	K3

TEXT BOOKS:

1. Thomas Martin Deserno, “Biomedical Image Processing”, Springer, 2011.
2. G.R.Sinha and B.C.Patel, “Medical Image Processing: Concepts and Applications”, Prentice Hall, 2014.

REFERENCES:

1. Karen M. Mudry, Robert Plonsey and Joseph D. Bronzino, “Biomedical Imaging”, CRC Press, 2003.
2. Z.H. Cho, J.P. Jones and M. Singh, “Foundations of Medical Imaging”, Wiley, 1993.
3. R.M.Rangayyan, “Biomedical Image Analysis”, CRC Press, Fifth Edition, 2005.
4. Kayvan Najarian and Robert Splinter, “Biomedical Signal and Image Processing”, CRC Press, Second Edition, 2014.
5. T.M.Deserno, “Biomedical Image Processing”, Springer, 2011.

20ECV61	NETWORK ON CHIP DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the relationship between semiconductor technology, computer architecture and computer networking in the design of the communication network for a MPSoC or a many-core design.
- To learn the basic concepts of Network-on-Chip design by studying the topologies, router design and MPSoC styles.
- To learn sample routing algorithms on a NoC with deadlock and livelock avoidance.
- To understand the role of system-level design and performance metrics in choosing a NoC design.

PRE-REQUISITE:

Course Code: 20EC505, 20EC602

Course Name: Digital VLSI Design and FPGA Implementation, Communication Networks

UNIT - I INTRODUCTION TO NOC **9**

Introduction to NOC - OSI layer rules in NOC - Interconnection networks in Network-on-Chip Network topologies - Switching techniques - Routing strategies - Flow control protocol quality-of-service support.

UNIT - II ARCHITECTURE DESIGN **9**

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 - III ROUTING ALGORITHM **9**

Packet routing - QOS - Congestion control and flow control - Router design - Network link design - Efficient and deadlock-free tree-based multicast routing methods - Path-based multicast routing for 2D and 3D mesh networks - Fault-tolerant routing algorithms - Reliable and adaptive routing algorithms.

UNIT - IV FAULT TOLERANCE OF NOC **9**

Design-security in Networks-on-Chips - Formal verification of communications in Networks-on Chips - Test and fault tolerance for Networks-on-Chip infrastructures - Monitoring services for Networks-on-Chips.

UNIT - V THREE-DIMENSIONAL INTEGRATION OF NETWORK-ON-CHIP **9**

Three-dimensional Networks-on-Chips architectures - A novel dimensionally-decomposed router for on-Chip communication in 3D architectures - Resource allocation for QoS on-Chip communication - Networks-on-Chip protocols - on-Chip processor traffic modeling for Networks-on-Chip.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Network On Chip Design		**Course Code :** 20ECV61
CO	**Course Outcomes**	**K-CO**
C350.1	Explain the various concepts of network-on-chip.	K2
C350.2	Discuss the relationship between semiconductor technology, computer architecture and computer networking in the design of the on-chip communication network.	K2
C350.3	Compare the different architecture designs.	K2
C350.4	Discuss the different routing algorithms.	K2
C350.5	Describe the fault tolerant NOC design.	K2
C350.6	Explain the three-dimensional architectures of NOC.	K2

TEXT BOOKS:

1. Santanu Chattopadhyay and Santanu Kundu, "Network-on-Chip: The Next Generation of System-on-Chip Integration", CRC Press, First Edition, 2014.
2. Maurizio Palesi and Masoud Daneshtalab, "Routing Algorithms in Networks-on-Chip", Springer Nature, 2014.

REFERENCES:

1. Chita R. Das, Chrysostomos Nicopoulos and Vijaykrishnan Narayanan, "Network-on-Chip Architectures: A Holistic Design Exploration", Springer, 2010.
2. Fayez Gebali, Haytham Elmiligi and Mohamed Watheq El-Kharashi, "Networks-on-Chips: Theory and Practice", CRC Press, First Edition, 2017.
3. Konstantinos Tatas, Kostas Siozios, Dimitrios Soudris and Axel Jantsch, "Designing 2D and 3D Network-on-Chip Architectures", Springer, 2016.
4. Sheng Ma, Libo Huang, Mingche Lai, Wei Shi and Zhiying Wang, "Networks-on-Chip: From Implementations to Programming Paradigms", Morgan Kaufmann, 2014.
5. Fayez Gebali, Haytham Elmiligi and Mohamed Watheq El-Kharashi, "Networks-on-Chips: Theory and Practice", CRC Press, First Edition, 2009.

20ECV62	RADAR TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Radar and Radar equation.
- To understand the types of Radar.
- To understand tracking Radar.
- To understand the various signal processing in Radar.
- To understand the subsystems in Radar.

PRE-REQUISITE: - NIL

UNIT - I INTRODUCTION TO RADAR EQUATION **9**

The Origins of Radar, Radar principles, Basic Block Diagram, Radar classifications based on Frequencies, Wave form and application, Radar Fundamentals: Detection, Range, velocity, The simple form of the Radar Equation, Pulsed Radar equation, Detection of Signals in Noise- Receiver Noise, Signal-to-Noise Ratio, Probabilities of Detection and False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, Pulse Repetition Frequency, Antenna Parameters, System losses.

UNIT - II CW, MTI AND PULSE DOPPLER RADAR **9**

CW and Frequency Modulated Radar, Doppler and MTI Radar - Delay Line Cancellers, Staggered Pulse Repetition Frequencies, Doppler Filter Banks, Digital MTI Processing, Moving Target Detector, Limitations to MTI Performance, MTI from a Moving Platform (AMIT), Pulse Doppler Radar.

UNIT - III TRACKING RADAR **9**

Tracking with Radar, Monopulse Tracking, Conical Scan, Sequential Lobing, Limitations to Tracking Accuracy, Low-Angle Tracking - Comparison of Trackers, Track while Scan (TWS) Radar- Target prediction, state estimation, Measurement models, alpha - beta tracker, Kalman Filtering, Extended-Kalman filtering.

UNIT - IV RADAR SIGNAL PROCESSING **9**

Radar Signal Processing Fundamentals, Detection strategies, Optimal detection, Threshold detection, Constant False alarm rate detectors, Adaptive CFAR, pulse compression waveforms, compression gain, LFM waveforms matched filtering, radar ambiguity functions, radar resolution, Detection of radar signals in Noise and clutter, detection of non-fluctuating target in noise, Doppler spectrum of fluctuating targets, Range Doppler spectrum of stationary and moving radar.

UNIT - V RADAR TRANSMITTERS AND RECEIVERS **9**

Radar Transmitter, Linear Beam Power Tubes, Solid State RF Power Sources, Magnetron, Crossed Field Amplifiers, Other RF Power Sources. The Radar Receiver, Receiver noise power, Super heterodyne Receiver, Duplexers and Receiver Protectors - Radar Displays. Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas - Phase Shifters.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Radar Technologies		**Course Code :** 20ECV62
CO	**Course Outcomes**	**K-CO**
C351.1	Identify the different Radar parameters and derive the Radar equation.	K2
C351.2	Differentiate various Radar types.	K2
C351.3	Explain different tracking and filtering schemes.	K2
C351.4	Apply Signal Processing in target detection.	K3
C351.5	Apply the detection of radar signal in noise and demonstrate noise figure.	K3
C351.6	Develop Radar transmitters and Receiver blocks.	K3

TEXT BOOKS:

1. Habibur Rahman, “Fundamental Principles of Radar”, CRC press, Taylor and Francis, 2019.
2. M.R.Richards, J.A.Scheer and W.A.Holm, “Principles of Modern Radar: Basic Principles”, SciTech Publishing, 2012.

REFERENCES:

1. Nathansan, “Radar design principles, Signal processing and environment”, PHI, Second Edition, 2007.
2. M.I.Skolnik , “Introduction to Radar Systems”, Tata McGraw Hill, 2006.
3. Mark A. Richards, “Fundamentals of Radar Signal Processing”, McGraw-Hill, 2005.

20ECV63 SOFTWARE DEFINED RADIO

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concepts of software radios.
- To know about RF implementation challenges for software defined radios.
- To understand the digital generation of signals.
- To know about Smart antennas for SDR.
- To learn the software and hardware requirements for software defined radios.

PRE-REQUISITE: - NIL -

UNIT - I INTRODUCTION TO SOFTWARE RADIO AND RF FRONT END 9

The Need for Software Radios. what is a software radio, Characteristics and Benefits of a Software Radio. Design Principles of a Software Radio. Purpose of RF front-end, Dynamic range, RF receiver front-end topologies.

UNIT - II RADIO FREQUENCY IMPLEMENTATION ISSUES 9

Enhanced flexibility of the RF chain with software radios, Importance of the components to overall performance, Transmitter architectures and their issues, Noise and distortion in the RF chain, ADC and DAC distortion, Predistortion, flexible RF systems using micro electro mechanical systems.

UNIT - III DIGITAL GENERATION OF SIGNALS 9

Hybrid DDS – PLL systems, Applications of Direct Digital Synthesis. Comparison of direct digital synthesis with analog signal synthesis, Approaches to direct digital synthesis, Analysis of spurious signals, Performance of direct digital synthesis systems, Applications of direct digital synthesis.

UNIT - IV SMART ANTENNAS 9

Introduction, vector channel modeling, benefits of smart antennas, structure for Beam forming systems, smart antenna algorithms, diversity and space-time adaptive signal processing. Algorithms for transmit STAP, hardware implementation of smart antennas. Digital Hardware Choices-Key hardware elements.

UNIT - V HARDWARE AND SOFTWARE FOR SDR & CASE STUDIES 9

DSP Processors, FPGA, ASICs. Trade-offs, Object oriented programming, Object Brokers, GNU Radio-USRP. Case Studies: SPEAK easy, JRTS, SDR-3000. Digital transceiver subsystem, spectrum ware.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Software Defined Radio		**Course Code :** 20ECV63
CO	**Course Outcomes**	**K-CO**
C352.1	Demonstrate an understanding in the evolving paradigm of Software defined radio and technologies for its implementation.	K3
C352.2	Explain about RF front end.	K2
C352.3	Identify radio frequency implementation issues.	K3
C352.4	Identify various digital synthesis procedures.	K3
C352.5	Illustrate smart antenna techniques for software defined radio.	K3
C352.6	Classify various hardware and software requirements for software defined radios.	K3

TEXT BOOKS:

1. Jeffrey Hugh Reed, “Software Radio: A Modern Approach to Radio Engineering”, Prentice Hall Professional, 2002.
2. Tony J. Rouphael, “RF and DSP for SDR”, Elsevier Newnes Press, 2008.

REFERENCES:

1. P. Kenington, “RF and Baseband Techniques for Software Defined Radio”, Artech House, 2005.
2. Paul Burns, “Software Defined Radio for 3G”, Artech House, 2002.
3. Behrouz. F. Bourjney, “Signal Processing for Software defined Radios”, Lulu, 2008.

20ECV64 VIRTUAL REALITY AND AUGMENTED REALITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn rapidly evolving and commercially viable field of computer science.
- To become familiar with geometric modeling and computer graphics.
- To learn various types of Hardware and Software in virtual Reality systems.

PRE-REQUISITE: - NIL

UNIT - I INTRODUCTION TO VIRTUAL REALITY **9**

Virtual Reality and Virtual Environment: Introduction – Computer graphics – Real time computer graphics – Flight Simulation – Virtual environment requirement – benefits of virtual reality – Historical development of VR – Scientific Landmark.

UNIT - II AUGMENTED REALITY **9**

Taxonomy – technology and features of augmented reality – difference between AR and VR – Challenges with AR – AR systems and functionality – Augmented reality method – visualization techniques for augmented reality – enhancing interactivity in AR environments – evaluating AR systems.

UNIT - III COMPUTER GRAPHICS AND GEOMETRIC MODELING **9**

Introduction – The Virtual world space – positioning the virtual observer – The perspective projection – Human vision – Stereo perspective projection – Colour theory. Geometrical Transformations: Introduction – frames of reference – Modeling transformations – scaling the VE – Collision detection.

UNIT - IV DEVELOPMENT TOOLS AND FRAMEWORK **9**

Human factors – Hardware – Software – The somatic senses – Sensor hardware – Head coupled displays – Acoustic hardware – Integrated VR systems – Modeling virtual world – Physical simulation.

UNIT - V AUGMENTED AND VIRTUAL REALITY APPLICATION **9**

Virtual Reality Applications: Introduction – Engineering – Entertainment – Education. The Future: Introduction – Virtual environments – modes of interaction. Case study on Oculus Rift – Head mounted display.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Virtual Reality and Augmented Reality		**Course Code :** 20ECV64
CO	**Course Outcomes**	**K-CO**
C353.1	Explain the virtual reality and environment, virtual reality requirements and benefits.	K2
C353.2	Illustrate the visualization techniques for augmented reality.	K2
C353.3	Discuss the concept of computer graphics and geometric modeling.	K2
C353.4	Use various types of hardware and software in virtual reality systems.	K3
C353.5	Apply development tools and framework for virtual reality.	K3
C353.6	Analyze and design a system or process to meet given specifications with realistic engineering constraints.	K4

TEXT BOOKS:

1. Jernej Barbic, Mirabelle D'Cruz, Marc Erich Latoschik, Mel Slater and Patrick Bourdot, “Virtual Reality and Augmented Reality”, 14th EuroVR International Conference, EuroVR 2017, Laval, France, December 12–14, 2017, Proceedings: 10700 (Lecture Notes in Computer Science).
2. Timothy Jung and M.Claudia tom Diek, “Augmented Reality and Virtual Reality”, Progress in IS (PROIS), 2018.

REFERENCES:

1. Grigore C. Burdea and Philippe Coiffet, “Virtual Reality Technology”, Wiley-IEEE Press, Second Edition, 2017.
2. Alan B. Craig, “Understanding Augmented Reality, Concepts and Applications”, Morgan Kaufmann, First Edition, 2013.
3. Alan B. Craig Dr., William R. Sherman Dr. and Jeffrey D. Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.
4. John Vince, “Virtual Reality Systems”, Pearson Education Asia, 2007.

20ECV65	COMMUNICATING EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn basics of CAN bus and its OSI models
- To understated various frames in CAN
- To learn the principles, operation, and programming of MCP2515 CAN Controller
- To learn various CAN development tools
- To learn built-in functions in STM32 for CAN controller

PRE-REQUISITE: - NIL

UNIT - I CAN BUS AND ITS OSI MODEL **9**

Vehicle Network Systems - CAN Bus - LIN - MOST - Byteflight - Intellibus - A Brief History of CAN Bus - CAN in Automotive Industry - The Basic Structure of a CAN Automotive System - Advantages of CAN Bus - Disadvantages of CAN Bus - Properties of CAN Bus - The ISO/OSI Reference Model and CAN - CAN Bus ISO/OSI Model - CANopen - CAN Bus Termination - CAN Bus Data Rate - Cable Stub Length - CAN Bus Node - CAN Bus Signal Levels - CAN_H Voltage - CAN_L Voltage - CAN Signal Waveform - Bus Arbitration - Bus Transceiver - CAN Connectors - CAN Repeaters - CAN PC Interface.

UNIT - II CAN BUS FRAMES **9**

Data Frame - Start Of Frame (SOF) - Arbitration Field - RTF Field - Control Field - Data Field - CRC Field - ACK Field - End of Frame Field - Remote Frame - Error Frame - Overload Frame - Extended CAN Frames - Bit Stuffing - Bus Error Detection - Bit Error - Bit Stuffing Error - CRC Error - Frame Error - ACK Error - CAN Bus Fault Confinement - Data Exchange With Data Frames - Remote Frames on the Bus.

UNIT - III CAN BUS TIMING AND CONTROLLER **9**

Bit Timing - Selection of Bit Timing Segments - The Prop_Seg - Oscillator Tolerance - The Basic Structure of a CAN Transceiver - The Basic Structure of a CAN Controller - The MCP2515 CAN Controller (Without Built-in Transceiver) - The MCP2515 CAN Controller (With Built-in Transceiver).

UNIT - IV CAN BUS DEVELOPMENT TOOLS **9**

Hardware Development Tools - CAN MicroMOD Development Kit - mikroElektronika CAN Communication Kit - The RCDK8C CAN Development Kit - mikroElektronika CAN SPI Click Board - mikroElektronika CAN-1 board - CAN Bus Monitor Demo Board - CAN Bus Analyzers - Microchip Inc CAN Bus Analyzer - CANdo - PCAN Explorer - CAN-Bus-Tester 2 (CBT2) - BitScope Logic - LAP-C Logic Analyzer - CAN Bus Software Development Tools - Keil Real-Time Library (RL-ARM) - mikroElektronika mikroC Pro for ARM - STM32F2xx Standard Peripheral Library.

UNIT - V STM32 BUILT-IN CAN BUS FUNCTIONS **9**

The STM32 Family of ARM Microcontrollers - The STM32F107VCT6 Microcontroller - Basic Features of the STM32F407VCT6 - Internal Block Diagram - The Power Supply - Low Power Modes - The Clock Circuit-STM32F407VGT6 Microcontroller Built-in CAN Controller Module - Message Transmission - Message Reception - mikroC Pro for ARM CAN Bus Functions - Using a Logic Analyzer as a CAN Bus Analyzer - Using the Microchip Inc CAN Bus Analyzer (APGDT002) - Connecting the CAN BUS Analyzer to the PC and CAN BUS.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Communication Embedded Systems		**Course Code :** 20ECV65
CO	**Course Outcomes**	**K-CO**
C354.1	Explain the CAN bus and its OSI model.	K2
C354.2	Describe various frames, its error detection and correction.	K2
C354.3	Use MCP2515 CAN controller as trans receiver.	K2
C354.4	Discuss different development tools for CAN.	K3
C354.5	Apply built-in functions of STM32 for CAN controller.	K3
C354.6	Use CAN bus analyzer to connect with PC and CAN.	K3

TEXT BOOKS:

1. Ibrahim Dogan, “Controller Area Network Projects with ARM and Arduino”, Publitr Elektor, August 15, 2011.
2. Wilfried F. Voss, “A Comprehensible Guide to Controller Area Network”, Copperhill Media, August 2005.

REFERENCES:

1. Marco Di Natale, Haibo Zeng, Paolo Giusto and Arkadeb Ghosal, “Understanding and Using the Controller Area Network Communication Protocol Theory and Practice”, Springer New York, 2012.
2. Ibrahim Dogan, “Controller Area Network Projects with ARM and Arduino”, Publitr Elektor, 2016.

20ECV66	WIRELESS SENSOR NETWORK DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamentals of wireless sensor network.
- To gain knowledge on the MAC and Routing Protocols of WSN.
- To get exposed to 6LOWPAN technology.
- To acquire knowledge on the protocols required for developing real time applications using WSN and 6LOWPAN.
- To gain knowledge about operating system related to WSN and 6LOWPAN.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION **9**

Principle of Wireless Sensor Network - Introduction to wireless sensor networks - Challenges, Comparison with ad hoc network, Node architecture and Network architecture, design principles, Service interfaces, Gateway, Short range radio communication standards - IEEE 802.15.4, Zigbee and Bluetooth. Physical layer and transceiver design considerations.

UNIT - II MAC AND ROUTING PROTOCOLS **9**

MAC protocols - fundamentals, low duty cycle protocols and wakeup concepts, contention and Schedule-based protocols - SMAC, BMAC,TRAMA, Routing protocols - Requirements, Classification - SPIN, Directed Diffusion, COUGAR, ACQUIRE, LEACH, PEGASIS.

UNIT - III 6LOWPAN **9**

6LoWPAN Architecture - protocol stack, Adaptation Layer, Link layers - Addressing, Routing - Mesh-Under - Route-Over, Header Compression - Stateless header compression - Context- based header compression, Fragmentation and Reassembly , Mobility - types, Mobile IPv6, Proxy Home Agent, Proxy MIPv6, NEMO - Routing - MANET, ROLL, Border routing.

UNIT - IV APPLICATION **9**

Design Issues, Protocol Paradigms - End-to-end, Real-time streaming and sessions, Publish/subscribe, Web service paradigms, Common Protocols - Web service protocols, MQ telemetry transport for sensor networks (MQTT-S), ZigBee compact application protocol (CAP), Service discovery, Simple network management protocol (SNMP), Real-time transport and sessions, Industry-Specific protocols.

UNIT - V TOOLS **9**

Tiny OS - Introduction, NesC, Interfaces, modules, configuration, Programming in Tiny OS using NesC, TOSSIM, Contiki - Structure, Communication Stack, Simulation environment - Cooja simulator, Programming.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Wireless Sensor Network Design		**Course Code :** 20ECV66
CO	**Course Outcomes**	**K-CO**
C355.1	Design solutions for WSNs applications.	K2
C355.2	Develop efficient MAC and Routing Protocols.	K3
C355.3	Design solutions for 6LOWPAN applications.	K2
C355.4	Develop efficient layered protocols in 6LOWPAN.	K2
C355.5	Design industry specific protocols applications.	K3
C355.6	Apply Tiny OS and Contiki OS in WSNs and 6LOWPAN applications.	K3

TEXT BOOKS:

1. Holger Karl and Andreas willig, “Protocol and Architecture for Wireless Sensor Networks”, John Wiley Publication, 2006.
2. Anna Forster, “Introduction to Wireless Sensor Networks”, Wiley, 2017.

REFERENCES:

1. Zach Shelby Sensinode and Carsten Bormann, “6LoWPAN: The Wireless Embedded Internet” John Wiley and Sons, Ltd., 2009.
2. The Contiki Operating System. http://www.sics.se/contiki.

20ECV71	IC FABRICATION TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To teach fundamental principles of fabrication of VLSI devices and circuits.
- To understand the different techniques and measures for IC fabrication.
- To apply fabrication principles in industry as a fabrication engineer.
- To contribute for further research in IC fabrication.
- To discuss physical mechanism in novel devices.

PRE-REQUISITE:

Course Code: 20EC505
Course Name: Digital VLSI Design and FPGA Implementation

UNIT - I Environment and Crystal Growth for VLSI Technology 9

Environment: Semiconductor technology trend, Clean rooms, Wafer cleaning.

Semiconductor Substrate: Phase diagram and solid solubility, Crystal structure, Crystal defects, Czochralski growth, Bridgman growth of GaAs, Float Zone growth, Wafer Preparation and specifications.

UNIT - II Fabrication Processes Part 1 9

Deposition: Evaporation, Sputtering and Chemical Vapor Deposition.

Epitaxy: Molecular Beam Epitaxy, Vapor Phase Epitaxy, Liquid Phase Epitaxy, Evaluation of epitaxial layers.

Silicon Oxidation: Thermal oxidation process, Kinetics of growth, Properties of Silicon Dioxide, Oxide Quality, high κ and low κ dielectrics.

Diffusion: Nature of diffusion, Diffusion in a concentration gradient, diffusion equation, impurity behavior, diffusion systems, problems in diffusion, evaluation of diffused layers.

Ion Implantation: Penetration range, ion implantation systems, process considerations, implantation damage and annealing.

UNIT - III Fabrication Processes Part 2 9

Etching: Wet chemical etching, dry physical etching, dry chemical etching, reactive ion etching, ion beam techniques.

Lithography: Photoreactive materials, Pattern generation and mask making, pattern transfer, Electron beam, Ion beam and X-ray lithography.

Device Isolation, Contacts and Metallization: Junction and oxide isolation, LOCOS, trench isolation, Schottky contacts, Ohmic contacts, Metallization and Packaging.

CMOS Process Flow: N well, P-well and Twin tub Design rules, Layout of MOS based circuits (gates and combinational logic), Buried and Butting Contact.

UNIT - IV Measurements, Packaging and Testing 9

Semiconductor Measurements: Conductivity type, Resistivity, Hall Effect Measurements, Drift Mobility, Minority Carrier Lifetime and diffusion length.

Packaging: Integrated circuit packages, Electronics package reliability.

Testing: Technology trends affecting testing, VLSI testing process and test equipment, test economics and product quality.

UNIT - V SOI, GaAs and Bipolar Technologies 9

SOI Technology: SOI fabrication using SIMOX, Bonded SOI and Smart Cut, PD SOI and FD SOI Device structure and their features.

GaAs Technologies: MESFET Technology, Digital Technologies, MMIC technologies, MODFET and Optoelectronic Devices.

Silicon Bipolar Technologies: Second order effects in bipolar transistor, Performance of BJT, Bipolar processes and BiCMOS.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : IC Fabrication Technology		**Course Code :** 20ECV67
CO	**Course Outcomes**	**K-CO**
C356.1	Explain the operation of a cleanroom.	K2
C356.2	Describe the basic operation principles of semiconductor fabrication equipment.	K2
C356.3	Discuss the process modules available in IC fabrication.	K2
C356.4	Explain the design process flows of IC fabrication technologies.	K2
C356.5	Discuss the effects of process parameters on final transistor characteristics.	K2
C356.6	Explain the measurement skills for microelectronic devices and IC characterization.	K2

TEXT BOOKS:

1. Shubham Kumar and Ankaj Gupta, "Integrated Circuit Fabrication", CRC Press, First Edition, 2021.
2. Simon Sze, "VLSI Technology", McGraw Hill Education, Second Edition, 2017.

REFERENCES:

1. Simon M. Sze and Ming-Kwei Lee, "Semiconductor Devices: Physics and Technology", Wiley, Third Edition, 2016.
2. James D. Plummer, Michael D. Deal and Peter B. Griffin, "Silicon VLSI Technology: Fundamentals Practice and Modeling", Pearson India, First Edition, 2009.
3. Gary S. May and Simon M. Sze, "Fundamentals of Semiconductor Fabrication", John Wiley & Sons Inc., First Edition, 2007.
4. Stephen A. Campbell, "The Science and Engineering of Microelectronic Fabrication", Oxford University Press Inc., Second Edition, 2001.
5. C.Y.Chang and S.M.Sze, "ULSI Technology", McGraw-Hill Higher Education, 1996.

20ECV72	MASSIVE MIMO NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain knowledge about massive MIMO networks.
- To understand the massive MIMO propagation channels.
- To learn about channel estimation in single cell and multicell massive MIMO systems.
- To comprehend the concepts of massive MIMO deployment in the context of single cell and multicell deployment.

PRE-REQUISITE: - NIL -

UNIT - I MASSIVE MIMO NETWORKS **9**

Definition of Massive MIMO, Correlated Rayleigh Fading, System Model for Uplink and Downlink, Basic Impact of Spatial Channel Correlation, Channel Hardening and Favorable Propagation, Local Scattering Spatial Correlation Model.

UNIT - II THE MASSIVE MIMO PROPAGATION CHANNEL **9**

Favorable Propagation and Deterministic Channels - Capacity Upper Bound - Distance from Favorable Propagation - Favorable Propagation and Linear Processing-Singular Values and Favorable Propagation, Favorable Propagation and Random Channels - Independent Rayleigh Fading - Uniformly Random Line-of-Sight (UR-LoS) - Independent Rayleigh Fading versus UR-LoS - Finite-Dimensional Channels.

UNIT - III SINGLE-CELL SYSTEMS **9**

Uplink Pilots and Channel Estimation - Orthogonal Pilots - De-Spreading of the Received Pilot Signal - MMSE Channel Estimation, Uplink Data Transmission - Zero-Forcing - Maximum-Ratio, Downlink Data Transmission - Linear Precoding - Zero-Forcing - Maximum-Ratio, Discussion - Interpretation of the Effective SINR Expressions.

UNIT - IV MULTI-CELL SYSTEMS **9**

Uplink Pilots and Channel Estimation, Uplink Data Transmission - Zero-Forcing - Maximum-Ratio, Downlink Data Transmission - Zero-Forcing - Maximum-Ratio, Discussion - Asymptotic Limits with Infinite Numbers of Base Station Antennas - The Effects of Pilot Contamination - Non-Synchronous Pilot Interference.

UNIT - V CASE STUDIES **9**

Single-Cell Deployment Example: Fixed Broadband Access in Rural Area, Multi-Cell Deployment: Preliminaries and Algorithms, Multi-Cell Deployment Examples: Mobile Access - Dense Urban Scenario - Suburban Scenario - Minimum Per-Terminal Throughput Performance -Additional Observations - Comparison of Power Control Policies.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Massive MIMO Networks		**Course Code :** 20ECV72
CO	**Course Outcomes**	**K-CO**
C357.1	Understand and explain massive MIMO networks.	K2
C357.2	Explain massive MIMO propagation channels and their capacity bounds	K2
C357.3	Apply channel estimation techniques for single cell system.	K2
C357.4	Apply channel estimation techniques for multi cell system.	K2
C357.5	Illustrate the concepts of the deployment of single cell massive MIMO system.	K2
C357.6	Illustrate the concepts of the deployment of multi cell massive MIMO system.	K2

TEXT BOOKS:

1. Thomas L. Marzetta, Erik G. Larsson, Hong Yang and Hien Quoc Ngo, “Fundamentals of Massive MIMO”, Cambridge University Press, 2016.
2. Emil Björnson, Jakob Hoydis and Luca Sanguinetti, “Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency”, Foundations and Trends, 2017.

REFERENCES:

1. Long Zhao, Hui Zhao and Kan Zheng, “Wei Xiang Massive MIMO in 5G Networks: Selected Applications”, Springer 2018.
2. Leibo Liu, Guiqiang Peng and Shaojun Wei, “Massive MIMO Detection Algorithm and VLSI Architecture”, Springer 2019.
3. Shahid Mumtaz, Jonathan Rodriguez and Linglong Dai, “mmWave Massive MIMO A Paradigm for 5G”, Elsevier, 2017.

20ECV73	VIDEO ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart knowledge on the basic principles and concepts in digital image and video processing.
- To explore and demonstrate real time image and video analytics in solving practical problems of commercial and scientific interests.

PRE-REQUISITE: - NIL -

UNIT - I INTRODUCTION IMAGE SEGMENTATION AND COLOUR IMAGE PROCESSING 9

Overview of Image processing system – Image Enhancement – Image Segmentation – Detection of Discontinuities – Edge Linking and Boundary Detection – Thresholding – Region-Based Segmentation – Colour Image Processing – Transformations – Image Smoothing and Sharpening – Noise Reduction – Colour based Image Segmentation.

UNIT - II OBJECT RECOGNITION AND IMAGE RETRIEVAL 9

Overview of Object Recognition – Feature Extraction – Intensity features – Shape feature extraction – PCA – SIFT – SURF – Texture Analysis: statistical, structural and spectral analysis – Bayes' Parametric classification – Feature Selection and Boosting – Image Retrieval – Content – Feature and Object.

UNIT - III DIGITAL VIDEO PROCESSING, VIDEO SEGMENTATION AND TRACKING 9

Digital Video – Sampling of video signal – Video Enhancement and Noise Reduction – Rate control and buffering – H.264 – Inter frame Filtering Techniques – Fundamentals of Motion Estimation and Motion Compensation Change Detection – Background modelling – Motion Segmentation – Simultaneous Motion Estimation and Segmentation – Motion Tracking – Multi-target/Multi-camera tracking.

UNIT - IV VIDEO ANALYSIS AND FOREGROUND EXTRACTION 9

Video Analysis Action Recognition – Video based rendering – Context and scene understanding – Video Surveillance – Background estimation – Averaging – Gaussian Mixture Modelling – Optical Flow based Image Segmentation – Region growing – Region splitting – Morphological operations – erosion – Dilation – Tracking in a multiple camera environment.

UNIT - V VIDEO ANALYTICS FOR SECURITY, TRAFFIC MONITORING AND ASSISTANCE 9

Abandoned object detection – human behavioral analysis – human action recognition – perimeter security – crowd analysis and prediction of crowd congestion – Customer behavior analysis – people counting – Traffic rule violation detection – traffic congestion identification for route planning – Advanced Driver Assistance System.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Video Analytics		**Course Code :** 20ECV73
CO	**Course Outcomes**	**K-CO**
C358.1	Explain the concepts of colour image processing.	K2
C358.2	Identify the algorithm for feature extraction and retrieval of images.	K3
C358.3	Apply sampling for video enhancement and noise reduction.	K3
C358.4	Employ various methods for motion tracking.	K3
C358.5	Apply foreground extraction for video surveillance.	K3
C358.6	Describe the applications of video processing.	K2

TEXT BOOKS:

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Pearson Education, Fourth Edition, 2018.
2. NilanjanDey, Amira Ashour and Suvojit Acharjee, “Applied Video Processing in Surveillance and Monitoring Systems”, IGI Global, 2016.

REFERENCES:

1. Murat Tekalp, “Digital Video Processing”, Prentice Hall, Second Edition, 2015.
2. Oge Marques, “Practical Image and Video Processing using MATLAB”, Wiley-IEEE Press, 2011.
3. Yu Jin Zhang, “Image Engineering: Processing, Analysis and Understanding”, Tsinghua University Press, 2009.
4. Mark Nixon and Alberto S. Aquado, “Feature Extraction & Image Processing for Computer Vision”, Academic Press, Third Edition, 2012.
5. Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer, 2010.

20ECV75 IOT SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the operational technology of IoT.
- To study various vulnerabilities, threats and risks in IoT.
- To explain various IoT security needs and issues.
- To learn different testing tools and different attacks of IoT.

PRE-REQUISITE: - NIL -

UNIT - I INTRODUCTION TO OPERATIONAL TECHNOLOGY 9

Overview of industrial control systems (ICS), ICS operation & components, Perdue model, SCADA systems, Cyber-physical systems (CPS) & IoT.

UNIT - II IOT VULNERABILITIES, THREATS AND RISKS 9

STRIDE methodology, OWASP IoT vulnerabilities, Privacy and trust, Insufficient authentication/authorization, Insufficient access control, Attacks on IoT data, Attacks on IoT layered architecture, Security concerns in IoT applications, Security concerns in SCADA.

UNIT - III IOT PEN TESTING 9

Active vulnerability analysis tools, Port scanning, Operating system fingerprinting and version scanning, Penetration testing, Attack surface mapping.

UNIT - IV TOOLS, FRAMEWORK FIRMWARE REVERSE ENGINEERING 9

Exploitation Tools & Frameworks Exploitation using I2C & SPI, JTAG debugging and exploitation, understanding firmware, Extracting firmware, Manual firmware extraction, Automated file system extraction, Firmware internals, Backdooring a firmware, Static & dynamic analysis.

UNIT - V RADIO AND SIDE CHANNEL ATTACKS 9

Software defined radio, Exploiting ZIGBEE & BLE, Power analysis attack, Invasive attack, Perturbation attacks, Electromagnetic side channel attack, fault injection attack, timing attack, covert channel attacks.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : IOT Security		**Course Code :** 20ECV75
CO	**Course Outcomes**	**K-CO**
C359.1	Summarize the operational technology of IoT	K2
C359.2	Describe various vulnerabilities, threats & risks in IoT.	K2
C359.3	Classify various IoT security issues.	K3
C359.4	Use different testing tools for IoT. .	K3
C359.5	Identify to secure IoT from different attacks.	K3
C359.6	Relate various IoT security needs.	K3

TEXT BOOKS:

1. Shancang Li and Li Da Xu, “Securing the Internet of Things”, Syngress, First Edition, 2017.
2. Fei Hu, “Security and Privacy in Internet of Things (IoTs) Models, Algorithms, and Implementations”, CRC Press, First Edition, 2016.

REFERENCES:

1. Brian Russell and Drew Van Duren, “Practical Internet of Things Security”, Packt Publishing Limited, 2016.

20ECV76	BRAIN COMPUTER INTERFACE AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts of brain computer interface.
- To study the various signal acquisition methods.
- To study the signal processing methods used in BCI.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION TO BCI **9**

Fundamentals of BCI - Structure of BCI system - Classification of BCI - Invasive, Non-invasive and Partially invasive BCI - EEG signal acquisition - Signal Preprocessing - Artifacts removal.

UNIT - II ELECTROPHYSIOLOGICAL SOURCES **9**

Sensorimotor activity - Mu rhythm, Movement Related Potentials - Slow Cortical Potentials - P300 - Visual Evoked Potential - Activity of Neural Cells - Multiple Neuro mechanisms.

UNIT - III FEATURE EXTRACTION METHODS **9**

Time/Space Methods - Fourier Transform, PSD - Wavelets - Parametric Methods - AR, MA, ARMA models - PCA - Linear and Non-Linear Features.

UNIT - IV FEATURE TRANSLATION METHODS **9**

Linear Discriminant Analysis - Support Vector Machines - Regression - Vector Quantization - Gaussian Mixture Modeling - Hidden Markov Modeling - Neural Networks.

UNIT - V APPLICATIONS OF BCI **9**

Functional restoration using Neuro prosthesis - Functional Electrical Stimulation, Visual Feedback and control - External device control, Case study: Brain actuated control of mobile Robot.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Brain Computer Interface And Applications		**Course Code :** 20ECV76
CO	**Course Outcomes**	**K-CO**
C360.1	Describe BCI system and its potential applications.	K2
C360.2	Explain event related potentials and sensory motor rhythms.	K2
C360.3	Compute features suitable for BCI.	K3
C360.4	Classify how to model and analyze brain signals using AR, MA and ARMA models.	K3
C360.5	Classify the different types of classifier for a BCI system.	K4
C360.6	Describe BCI for various applications.	K2

TEXT BOOKS:

1. Rajesh P.N. Rao, "Brain-Computer Interfacing: An Introduction", Cambridge University Press, 2013.
2. Guido Dornhege, José del R. Millán, Thilo Hinterberger, Dennis J. McFarland and Klaus-Robert Müller, "Toward Brain-Computer Interfacing", The MIT Press, 2007.

REFERENCES:

1. Bernhard Graimann, Brendan Allison, Gert Pfurtscheller, “Brain Computer Interfaces: Revolutionizing Human-Computer Interaction”, Springer, 2010.
2. R.Spehlmann, “EEG Primer”, Elsevier Biomedical Press, 1981.
3. Arnon Kohen, “Biomedical Signal Processing”, Vol. I and II, CRC Press Inc., Boca Rato, Florida, 1986.
4. C.M.Bishop, “Neural Networks for Pattern Recognition”, Oxford, Clarendon Press, 1995.

20ECV83	MULTIMEDIA COMPRESSION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic ideas of compression algorithms related to multimedia components – Text, speech, audio, image and Video.
- To understand the principles and standards and their applications with an emphasis on underlying technologies, algorithms, and performance.
- To appreciate the use of compression in multimedia processing applications.
- To understand and implement compression standards in detail.

PRE-REQUISITE: NIL

UNIT - I FUNDAMENTALS OF COMPRESSION **9**

Introduction To multimedia – Graphics, Image and Video representations – Fundamental concepts of video, digital audio – Storage requirements of multimedia applications – Need for compression –Taxonomy of compression Algorithms - Elements of Information Theory – Error Free Compression – Lossy Compression.

UNIT - II TEXT COMPRESSION **9**

Huffman coding – Adaptive Huffman coding – Arithmetic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.

UNIT - III IMAGE COMPRESSION **9**

Image Compression: Fundamentals – Compression Standards – JPEG Standard – Sub-band coding – Wavelet Based compression – Implementation using Filters – EZW, SPIHT coders – JPEG 2000 standards – JBIG and JBIG2 standards.

UNIT - IV AUDIO COMPRESSION **9**

Audio compression Techniques – law, A-Law companding – Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 – MPEG audio – progressive encoding – Silence compression, Speech compression – Formant and CELP vocoders.

UNIT - V VIDEO COMPRESSION **9**

Video compression techniques and Standards – MPEG video coding: MPEG-1 and MPEG-2 video coding: MPEG-3 and MPEG-4 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – DVI real time compression – Current Trends in Compression standards.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Multimedia Comperssion Techniques		**Course Code :** 20ECV83
CO	**Course Outcomes**	**K-CO**
C361.1	Explain the various error free and lossless compression and quantization techniques.	K2
C361.2	Apply Huffman coding Arithmetic coding, Shannon fano coding, Dictionary techniques and other algorithm for text compression.	K3
C361.3	Compare various compression standards applying for image processing.	K4
C361.4	Compare various compression standards applying for audio processing.	K4
C361.5	Implement basic compression algorithms with MATLAB and its equivalent open source environments for audio compression.	K3
C361.6	Compare various compression standards applying for video processing.	K4

TEXT BOOKS:

1. Khalid Sayood, “Introduction to Data Compression”, Morgan Kauffman Harcourt India, Third Edition, 2010.
2. David Solomon, “Data Compression – The Complete Reference”, Springer Verlog, Fourth Edition, New York, 2006.

REFERENCES:

1. Yun Q. Shi and Huifang Sun, “Image and Video Compression for Multimedia Engineering, Algorithms and Fundamentals”, CRC Press, 2003.
2. Mark S. Drew and Ze-Nian Li, “Fundamentals of Multimedia”, PHI, 2009.

20ECV84 ETHICS AND AI

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the morality and ethics in AI.
- To learn about the Ethical initiatives in the field of artificial intelligence.
- To study about AI standards and regulations.
- To study about social and ethical issues of robot ethics.
- To study about AI and ethics challenges and opportunities.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION **9**

Definition of morality and ethics in AI - Impact on society - Impact on human psychology - Impact on the legal system - Impact on the environment and the planet - Impact on trust.

UNIT - II ETHICAL INITIATIVES IN AI **9**

International ethical initiatives - Ethical harms and concerns - Case study: health care robots, Autonomous Vehicles, Warfare and weaponization.

UNIT - III AI STANDARDS AND REGULATION **9**

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems - Data Privacy Process - Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems.

UNIT - IV ROBO ETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS **9**

Robot - Robo ethics - Ethics and Morality - Moral Theories - Ethics in Science and Technology - Ethical Issues in an ICT Society - Harmonization of Principles - Ethics and Professional Responsibility - Robo ethics Taxonomy.

UNIT - V AI AND ETHICS: CHALLENGES AND OPPORTUNITIES **9**

Challenges - Opportunities - ethical issues in artificial intelligence - Societal Issues Concerning the Application of Artificial Intelligence in Medicine - decision-making role in industries - National and International Strategies on AI.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Ethics And AI		**Course Code :** 20ECV84
CO	**Course Outcomes**	**K-CO**
C363.1	Describe about morality and ethics in AI.	K2
C363.2	Express the knowledge of real time application ethics, issues and its challenges.	K2
C363.3	Understand the ethical harms and ethical initiatives in AI.	K2
C363.4	Discuss about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems.	K2
C363.5	Understand the concepts of Robo ethics and Morality with professional responsibilities.	K2
C363.6	Explain the societal issues in AI with National and International Strategies on AI.	K2

TEXT BOOKS:

1. Y.Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield, “The ethics of artificial intelligence: Issues and initiatives”, European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452, March 2020.
2. Patrick Lin, Keith Abney and George A. Bekey, “Robot Ethics: The Ethical and Social Implications of Robotics”, The MIT Press, January 2014.

REFERENCES:

1. Paula Boddington, “Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms)” November 2017.
2. Mark Coeckelbergh, “AI Ethics”, The MIT Press Essential Knowledge Series, April 2020.

20HS5A1	MANAGEMENT CONCEPTS & ORGANIZATIONAL BEHAVIOR	L	T	P	C
		3	0	0	3

OBJECTIVES:

To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization with a perspective to diagnose and effectively handle human behavior**.**

PRE-REQUISITE:NIL

UNIT-I INTRODUCTION TO MANAGEMENT 9

Origin - Definition of management -Nature & Characteristics of management - Scope of management - Importance of Management - Difference between administration & management- Levels of management -Functions of Management - Principles of management - Management by objectives - Management by exception .

UNIT-II PLANNINGAND ORGANIZING 9

Definitions of planning -Nature of planning - Importance of planning - Limitations of planning - Process / steps of planning -Elements of planning - Decision making - Characteristics of decision making - Process / steps of decision making-Nature of Organisation-Principles of Organisation - Advantages of Organisation - Process / steps of Organisation - Formal & Informal Organisation - Organisational Structure (Types) - Organisation chart - delegation - Process / steps of delegation - Centralisation - De-Centralisation

UNIT - III CO-ORDINATION AND CONTROLLING 9

Definition of Co-ordination - characteristics of Co-ordination - Benefits of Co-ordination - Problems in Coordination -Techniques of Co-ordination - Definition of controlling - characteristics of control function – Control process –Communication - Characteristics of Communication - Process of Communication - Formal &Informal Communication - Upward & Downward Communication - Sideward Communication – Written Communication -Barriers in Communication - Measures to overcome communication barriers

UNIT - IV INDIVIDUAL BEHAVIOUR 9

Meaning of Organizational behavior, contributing disciplines, importance of organizational behavior, Perception and Learning - Personality and Individual Differences - Motivation theories and Job Performance - Values, Attitudes and Beliefs - Communication Types-Process - Barriers - Making Communication Effective.

UNIT - V GROUP BEHAVIOUR 9

Groups and Teams: Definition, Difference between groups and teams, Stages of Group Development, Group Cohesiveness, Types of teams, Group Dynamics - Leadership - Styles - Approaches - Power and Politics .

TOTAL:45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Managemet Concepts & Organizational Behaviour		**Course Code :** 20HS5A1
CO	**Course Outcomes**	**K-CO**
C317.1	Explain Management principles into management practices and Managers manage business in global context with different strategies and to determine the effective ways of controlling, and decision making.	K2
C317.2	Understand and explain all the managerial functions.	K2
C317.3	Demonstrate the applicability of the concept of organizational behavior to understand the behavior of people in the organization and management of individual behavior in the organization.	K2
C317.4	Analyze the complexities associated with management of the group behavior in the organization.	K2
C317.5	Demonstrate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization.	K2
C317.6	Managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management and the degree to which one can make an individual to think beyond self.	K3

REFERENCES:

1. Stephen P. Robins, Organizational Behavior, Pearson Education, Edition 16, 2022.
2. Steven L. Mc Shane, Mary Ann Von Glinow, et al. Organizational Behavior, Edition 9, 2022
3. PC Tripathi, PN Reddy, Ashish Bajpai, Principles of Management, Tata McGraw Hill,

20HS5A2 INDUSTRIAL MARKETING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the basics of Industrial Marketing.
- To know about the Management of Industrial Marketing
- To understand the methods of Strategic Planning and Implementation process.
- To learn the process of Logistics, Marketing Control and Channel Optimization
- To understand the techniques of Pricing and Sales Force Planning

PRE-REQUISITE:NIL

UNIT-I Basics of Industrial Marketing 9

Introduction to Industrial Marketing- Industrial versus Consumer Marketing- Economics of Industrial Demand Classification of Industrial Customers- Unique Characteristics of Organizational Procurement-Purchasing in Government Units.

UNIT-II Management of Industrial Marketing 9

Industrial Buying Behaviour in Indian context- Conceptualization of Buying Behavior-Stages in Buying Uncertainty Management in Industrial Marketing- Purchasing Agents in Industrial Buying-Negotiation in Industrial Marketing

UNIT - III Strategic Planning and Implementation 9

Process of Strategic Planning-Macro and Micro Variables Used to Segment Industrial Marketing- Managing the Development of Strategic Planning- Understanding Strategy Formulation and Strategy Implementation Industrial Marketing Strategy Components - Industrial Marketing Research for New Product Development Industrial Marketing Strategy in India

UNIT - IV Logistics, Marketing Control and Channel Optimization 9

Marketing Logistics- Physical Distribution and Customer Services- Marketing Control Channel Participants-Channel Functions and Dual Channels-Choosing the Right Distributor-Distribution and Manufacturers' Representatives

UNIT - V Pricing and Sales Force Planning 9

Price: A Crucial Element in Product Strategy- The nature of Derived Demand- Segregation of New Product Cost- Pricing in Industrial Marketing- Segregation of New Product Cost - Industrial Product Pricing in India Development of Industrial Sales Force-Motivation of Sales Force- Effective Use of Sales Compensation

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Industrial Marketing		**Course Code :** 20HS5A2
CO	**Course Outcomes**	**K-CO**
C318.1	Compare industrial vs consumer marketing and the classifications of industrial customers.	K2
C318.2	Develop Negotiation and buying techniques for industrial products .	K2
C318.3	Formulate strategic plan and implementation methods.	K2
C318.4	Develop techniques of Logistics, Marketing Control and Channel Optimization.	K2
C318.5	Identify Pricing tactics and Sales Force Planning techniques	K2
C318.6	Manage the entire industrial marketing process.	K3

REFERENCES:

1. Industrial Marketing: A Process of Creating and Maintaining Exchange by krishnamacharyulu Csg,Lalitha R, Publisher: Jaico Book House,
2. Industrial Marketing by Ghosh, Publisher: Oxford University Press,2019
3. Industrial Marketing 2e by K. K. Havaldar, Publisher: Tata McGraw-Hill Publishing Company limited,2016
4. Industrial Marketing Management by Govindarajan, Vikas Publishing House.2018
5. Industrial Marketing by Phadtare -M. T, Prentice Hall of India Private Limited ,2020

20HS6A1	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To get an adequate knowledge on patent and copyright for their innovative research works.
- To use in their career, information in patent documents provide useful insight on novelty of their idea from state-of-the art search. This provide further way for developing their idea or innovations.
- To pave the way to catch up Intellectual Property (IP) as an career option.
    - R & D IP Counsel
    - Government Jobs – Patent Examiner
    - Private Jobs
    - Patent agent and Trademark agent

PRE-REQUISITE: NIL

UNIT - I OVERVIEW OF INTELLECTUAL PROPERTY 9

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design - Genetic Resources and Traditional Knowledge - Trade Secret - IPR in India: Genesis and development - IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention - 1883, the Berne Convention - 1886, the Universal Copyright Convention - 1952, the WIPO Convention - 1967, the Patent Co-operation Treaty - 1970, the TRIPS Agreement - 1994.

UNIT - II PATENTS 9

Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non-Patentable Subject Matter - Registration Procedure - Rights and Duties of Patentee - Assignment and license - Restoration of lapsed Patents - Surrender and Revocation of Patents - Infringement - Remedies & Penalties - Patent office and Appellate Board.

UNIT - III COPYRIGHTS 9

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works - cinematograph films and sound recordings - Registration Procedure - Term of protection - Ownership of copyright - Assignment and license of copyright - Infringement - Remedies & Penalties - Related Rights - Distinction between related rights and copyrights.

UNIT - IV TRADEMARKS 9

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

UNIT - V OTHER FORMS OF IP & REGISTRATION PROCESS 9

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection. Geographical Indication (GI): meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection. IPR registration process through government website-modalities and publications. Plant Variety Protection: meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection. Layout Design Protection: meaning – Procedure for registration, effect of registration and term of protection.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Intellectual Property Rights		**Course Code :** 20HS6A1
CO	**Course Outcomes**	**K-CO**
C313.1	Explain the fundamental aspects of Intellectual property Rights which plays a major role in development and management of innovative projects in industries.	K2
C313.2	Describe the patents, patent regime in India and abroad and registration aspects.	K2
C313.3	Describe the copyrights and its related rights and registration aspects.	K2
C313.4	Explain the trademarks and registration aspects.	K2
C313.5	Explain the Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects.	K2
C313.6	Analyze the current trends in IPR and Government steps in fostering IPR.	K2

TEXT BOOKS:

1. K.V.Nithyananda, “Intellectual Property Rights: Protection and Management”, Cengage Learning India Pvt. Ltd., 2019.
2. P.Neeraj and D.Khusdeep, “Intellectual Property Rights”, PHI Learning Pvt. Ltd., 2014.

REFERENCES:

1. V.K.Ahuja, “Law Relating to Intellectual Property Rights”, Lexis Nexis, Third Edition, 2017.
2. Journal of Intellectual Property Rights (JIPR): NISCAIR
3. Cell for IPR Promotion and Management (http://cipam.gov.in/)
4. World Intellectual Property Organization (https://www.wipo.int/about-ip/en/)
5. Office of the Controller General of Patents, Designs & Trademarks (http://www.ipindia.nic.in/)

20HS6B1	PROJECT MANAGEMENT AND ENTREPRENEURSHIP	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make them understand the concepts of project management for planning to execution of projects.
- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

PRE-REQUISITE: NIL

UNIT - I PROJECT MANAGEMENT 9

Project management: meaning, scope & importance, role of project manager - Project life-cycle and Project appraisal - project feasibility report- Technical appraisal, Environmental appraisal, Market appraisal and Managerial appraisal.

UNIT - II PROJECT FINANCING 9

Project cost estimation & working capital requirements - sources of funds - capital budgeting - Risk & uncertainty in project evaluation - preparation of projected financial statements viz. Projected balance sheet - projected income statement - projected funds & cash flow statements - Preparation of detailed project report - Project finance.

UNIT - III ENTREPRENEURSHIP 9

Entrepreneurship need and scope - Entrepreneurial competencies and traits - Factors affecting entrepreneurial development - Entrepreneurial motivation (Mc Clellend's Achievement motivation theory) - conceptual model of entrepreneurship - entrepreneur vs. intrapreneur - Classification of entrepreneurs - Entrepreneurial Development Programmes.

UNIT - IV ENTREPRENEURIAL IDEA AND INNOVATION 9

Introduction to Innovation - Entrepreneurial Idea Generation and Identifying Business Opportunities - Management skills for Entrepreneurs and managing for Value Creation - Creating and Sustaining Enterprising Model - Organizational Effectiveness.

UNIT - V SOCIAL ENTREPRENEURSHIP 9

Social Sector Perspectives and Social Entrepreneurship - Social Entrepreneurship Opportunities and Successful Models - Social Innovations and Sustainability - Marketing Management for Social Ventures - Risk Management in Social Enterprises - Legal Framework for Social Ventures.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Project Management And EnterPreurship		**Course Code :** 20HS6B1
CO	**Course Outcomes**	**K-CO**
C314.1	Conclude the project characteristics and various stages of a project.	K6
C314.2	Compile the conceptual clarity about project organization and feasibility.	K5
C314.3	Apply the risk management plan and analyze the role of stakeholders.	K3
C314.4	Analyze the social responsibility for an entrepreneurship.	K4
C314.5	Interpret the gain knowledge to overcome the factors affecting small-scale business.	K3
C314.6	Formulate a new small-scale business	K6

REFERENCES:

1. Anil K. Gupta, “Grassroots Innovation: Minds on the Margin Are Not Marginal Minds”, Random House, 2016.
2. V.S.P.Rao, “Business, Entrepreneurship and Management”, Vikas Publishing, 2014.
3. Rajeev Roy, “Entrepreneurship”, Oxford University Press, 2011.
4. Roman Pichler, “Agile Product Management with Scrum Creating Products That Customers Love”, Pearson India, 2013.
5. John M. Nicholas and Herman Steyn, “Project Management for Engineering, Business and Technology”, A Butterworth-Heinemann Title, Fourth Edition, 2011

20HS7A2	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand TQM Concepts and importance of customers.
- To know about TQM Principles, understand about employee involvement and supplier partnership.
- To understand six sigma, Traditional tools, New tools, Benchmarking and FMEA.
- To understand Control charts, Taguchi Quality Loss function, QFD, TPM and Performance measures.
- To understand the various elements of Quality Management System and Environment Management System.

PREREQUISITE: NIL

UNIT - I INTRODUCTION 9

Quality – Need, Evolution, Definitions, Dimensions of product and service quality. TQM - Basic concepts, Framework, Contributions of Deming, Juran and Crosby, Barriers. Quality statements, Customer satisfaction, Customer complaints, Customer retention, Costs of quality

UNIT - II TQM PRINCIPLES **9**

Strategic quality planning, Quality Councils, Employee involvement, Motivation, Empowerment, Teamwork, Quality circles, Recognition and Reward, Performance appraisal, Continuous process improvement - PDCA cycle, 5S, Kaizen, Supplier partnership, Supplier selection, Supplier Rating.

UNIT - III TQM TOOLS AND TECHNIQUES I **9**

Traditional tools of quality, New management tools. Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT, Bench marking, Reason to bench mark, Bench marking process, FMEA - Stages, Types.

UNIT - IV TQM TOOLS AND TECHNIQUES II **9**

Control Charts, Process Capability, Quality Function Development (QFD), Taguchi quality loss function, TPM - Concepts, improvement needs, Performance measures.

UNIT - V QUALITY SYSTEMS **9**

Need for ISO 9000, ISO 9001-2008 Quality System, Elements, Documentation, Quality Auditing, QS 9000 - ISO 14000, Concepts, Requirements and Benefits, TQM Implementation in manufacturing and service sectors

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Dale H. Besterfiled, et at., "Total quality Management", Pearson Education Asia, 5th Edition, 2018.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", Cengage Learning, 8th Edition, 2012.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2nd Edition, 2006.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Total Quality Management		**Course Code :** 20HS7A2
CO	**Course Outcomes**	**K-CO**
C312.1	Explain basic concepts, TQM framework, Barriers Benefits of TQM and importance of customers	K2
C312.2	Explain the TQM Principles, understand the importance of employee involvement and supplier partnership	K2
C312.3	Explain the basics of Six Sigma, Traditional tools, New tools ,	K2
C312.4	Explain the process of Benchmarking and FMEA.	K2
C312.5	Explain process capability, QFD, TPM, Taguchi quality loss function and performance measures	K2
C312.6	Explain the Quality system ISO 9000, ISO 14000, Audit, Certification process and implementation of TQM in manufacturing and service sectors	K2

REFERENCES:

1. Joel.E. Ross, “Total Quality Management – Text and Cases”, CRC Press, 5th Edition, 2017.
2. Kiran.D.R, “Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 1st Edition, 2016.
3. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2012.
4. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 1st Edition, 2006.
5. Brue G, "Six Sigma for Managers”, Tata-McGraw Hill, 2nd Edition, 2002.

20HS8A1	HUMAN RELATIONS AT WORK	L	T	P	C
		3	0	0	3

OBJECTIVES:

• To create awareness of human relations at work its relationship with self.
• To create awareness about the processes involved in interaction with people at work.
• To understand the importance of psychological and physical health in maintaining human relations at work and progressing in career.

PRE-REQUISITE : NIL

UNIT-I INTRODUCTION TO HUMAN RELATIONS 9

Understanding and Managing Yourself – Human Relations and You – Self-Esteem and Self – Confidence – Self-Motivation and Goal Setting – Emotional Intelligence – Attitudes and Happiness – Values and Ethics – Problem Solving and Creativity.

UNIT-II HUMAN RELATIONS AT WORK 9

Dealing Effectively with People – Communication in the Workplace – Specialized Tactics for Getting Along with Others in the Workplace – Managing Conflict – Becoming an Effective Leader – Motivating Others and Developing Teamwork – Diversity and Cross-Cultural Competence.

UNIT - III STAYING PHYSICALLY HEALTHY 9

Yoga: Ashtanga, Yam and Niyam, Asan – Pranayam – Exercise: Aerobic and anaerobic.

UNIT - IV STAYING PSYCHOLOGICALLY HEALTHY 9

Managing Stress and Personal Problems – Meditation – Cognitive, behavioural and emotional well-being.

UNIT - V DEVELOPING CAREER THRUST 9

Getting Ahead in Your Career – Learning Strategies – Perception – Life Span Changes – Developing Good Work Habits.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Andrew DuBrin, “Human Relations for Career and Personal Success: Concepts, Applications, and Skills”, Pearson Education, Eleventh Edition, 2016.
2. Swami Vivekananda, “Raja-Yoga or Conquering the Internal Nature”, Vedanta Press, 1998.

REFERENCES:

1. Jerrold S. Greenberg, “Comprehensive Stress Management”, McGraw-Hill Humanities Social, Thirteenth Edition, 2012.

2.Y.Udai, “Yogasan aur pranayama”, N.S. Publications, New Delhi, 2015. Janardan Swami Yogabhyasi Mandal, “Yogic Asanas for Group Training - Part-I”,Nagpur.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Human Relations at Work		**Course Code :** 20HS8A1
CO	**Course Outcomes**	**K-CO**
C315.1	Implement the elements of Emotional Intelligence and create a plan for continual improvement.	K2
C315.2	Demonstrate the elements of teamwork such as team development stages, leadership skills, team dynamics, problems solving and decision making approaches, and team building.	K2
C315.3	Employ active listening skills including paraphrasing, questioning, empathetic listening, analytic listening, responding and communicating non-verbally while respecting individual differences.	K2
C315.4	Identify various Yoga Postures.	K2
C315.5	Develop an action plan to increase personal motivation in a personal and or workplace situation.	K2
C315.6	Identify different elements of organizational behavior and change including organizational climate, culture, power, ethics, and organizational development techniques to develop a change model for an aspect of their personal and or professional life.	K2

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20HS8B2	ECONOMICS FOR ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamental economic concepts
- To understand cost estimation concepts
- To understand value engineering
- To understand project appraisal and methods of analysis
- To understand the methods of depreciation

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION TO ECONOMICS 9

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis - V ratio, Elementary economic Analysis – Material selection for product Design selection of a product, Process planning.

UNIT - II COST ESTIMATION AND MACRO ECONOMICS 9

Cost and revenue concepts- Determination of equilibrium price under perfect competition - Banking – Inflation - National Income

UNIT - III VALUE ENGINEERING 9

Make or buy decision, Value engineering – Function, aims, Value engineering procedure: Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor - Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT - IV PROJECT APPRAISAL AND ANALYSIS 9

Methods of comparison of alternatives – present worth method (Revenue dominated cashflow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram),rate of return method, Examples in all the methods.

UNIT - V DEPRECIATION 9

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Economics For Engineers		**Course Code :** 20HS8B2
CO	**Course Outcomes**	**K-CO**
C316.1	Describe the concept of engineering economics\	K2
C316.2	Comprehend macroeconomic principles	K2
C316.3	Decision making in diverse business set up	K2
C316.4	Explain the Inflation & Price Change	K2
C316.5	Explain Present Worth Analysis	K2
C316.6	Apply the principles of economics through various case studies	K3

TEXT BOOK:

1. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi,2001.

REFERENCES:

1. ChanS.Park,“Contemporary Engineering Economics”, PrenticeHallofIndia,2011.
2. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg.Press,Texas,2010.
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, NewYork,2011.
4. ZahidAkhan:"Engineering Economy", DorlingKindersley,2012

20OE301 FUNDAMENTALS OF COMMUNICATION ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the various digital communication techniques.
- To study the various analog and digital modulation techniques.
- To impart knowledge on data and pulse communication techniques.
- To study the principles behind information theory and coding.
- To be familiarized with source and error control coding.
- To gain knowledge on spread spectrum and multiple access techniques.

PRE-REQUISITE: NIL

UNIT - I ANALOG MODULATION 9

Amplitude Modulation: AM, DSBSC, SSBSC, VSB - PSD, modulators and demodulators - Angle modulation - PM and FM - PSD, modulators and demodulators - Super heterodyne receivers.

UNIT - II PULSE MODULATION 9

Low pass sampling theorem - Quantization - PAM - Line coding - PCM - DPCM - DM - ADPCM - ADM - Channel Vocoder - Time Division Multiplexing - Frequency Division Multiplexing.

UNIT - III DIGITAL MODULATION AND TRANSMISSION 9

Phase shift keying: BPSK, DPSK, QPSK - Principles of M-ary signalling - M-ary PSK & QAM - Comparison - ISI - Pulse shaping - Duo binary encoding - Cosine filters - Eye pattern - equalizers.

UNIT - IV INFORMATION THEORY AND CODING 9

Measure of information - Entropy - Source coding theorem - Shannon-Fano coding, Huffman Coding - Channel capacity - Shannon-Hartley law - Shannon's limit - Error control codes - linear block codes - Cyclic codes - Syndrome calculation - Convolution Coding.

UNIT - V SPREAD SPECTRUM AND MULTIPLE ACCESS 9

PN sequences - properties - m-sequence - DSSS - Processing gain - Jamming - FHSS - Synchronization and tracking - Multiple Access: FDMA, TDMA, CDMA - Introduction to 4G and 5G.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Fundamentals Of Communication Engineering		**Course Code :** 20OE301
CO	**Course Outcomes**	**K-CO**
1	Explain the concepts of analog modulation techniques.	K2
2	Explain the concepts of pulse modulation techniques.	K2
3	Explain the concepts of digital modulation techniques.	K2
4	Apply various source-coding techniques to compute efficiency of the code.	K3
5	Apply various error control coding techniques to identify/correct errors.	K3
6	Explain the concepts of spread spectrum and multiple access techniques.	K2

TEXT BOOKS:

1) Wayne Tomosi, “Advanced Electronic Communications Systems”, Pearson Education Limited, Sixth Edition, 2011.
2) Simon Haykin, “Communication Systems”, Wiley, Fourth Edition, 2006.

REFERENCES:

1) J.G.Proakis and M.Salehi, “Fundamentals of Communication Systems”, Pearson Education 2014.
2) B.P.Lathi, “Modern Analog and Digital Communication Systems”, Oxford University Press, Third Edition, 2011.
3) H.P.Hsu, Schaum Outline Series, “Analog and Digital Communications”, TMH, 2009.
4) B.Sklar, “Digital Communication Fundamentals and Applications”, Pearson Education, Second Edition, 2009.
5) H.Taub, D.L.Schilling and G.Saha, “Principles of Communication”, Pearson Education, Third Edition, 2007.

20OE302 MICROPROCESSOR AND EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with peripherals.
- To understand the concepts of embedded system design and analysis.
- To learn the architecture and programming of ARM processor.

PRE-REQUISITE: NIL

UNIT - I THE 8086 MICROPROCESSOR 9

Introduction to 8086 - Microprocessor architecture - Addressing modes - Instruction set and assembler directives - Assembly language programming - Modular Programming - Linking and Relocation - Stacks - Procedures - Macros - Interrupts and interrupt service routines - Byte and String Manipulation.

UNIT - II 8086 SYSTEM BUS STRUCTURE 9

8086 signals - Basic configurations - System bus timing - System design using 8086 - I/O programming - Introduction to Multiprogramming - System Bus Structure - Multiprocessor configurations - Coprocessor - Closely coupled and loosely Coupled configurations - Introduction to advanced processors.

UNIT - III I/O INTERFACING 9

Memory Interfacing and I/O interfacing - Parallel communication interface - Serial communication interface - D/A and A/D Interface - Timer - Keyboard/display controller - Interrupt controller - DMA controller - Programming and applications Case studies: Traffic Light control, LED display and Alarm Controller.

UNIT - IV INTRODUCTION TO EMBEDDED SYSTEM DESIGN 9

Complex systems and microprocessors - Embedded system design process - Design example: Model train controller - Design methodologies - Design flows - Requirement Analysis - Specifications - System analysis and architecture design - Quality Assurance techniques - Designing with computing platforms - consumer electronics architecture - platform-level performance analysis.

UNIT - V ARM PROCESSOR AND PERIPHERALS 9

ARM Architecture Versions - ARM Architecture - Instruction Set - Stacks and Subroutines - Features of the LPC 214X Family - Peripherals - The Timer Unit - Pulse Width Modulation Unit - UART - Block Diagram of ARM 9 and ARM Cortex M3 MCU.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Microprocessor And Embedded Systems		**Course Code :** 20OE302
CO	**Course Outcomes**	**K-CO**
1	Explain the architecture of 8086 and its addressing modes.	K2
2	Construct 8086 Assembly language Programs.	K2
3	Illustrate I/O and Memory interfacing circuits.	K2
4	Build the Interfacing of microprocessors with various input output devices.	K3
5	Explain the concepts of embedded system design.	K3
6	Explain the architecture of ARM processor.	K2

TEXT BOOKS:

1. Yu-Cheng Liu and Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Prentice Hall of India, Second Edition, 2007.
2. Marilyn Wolf, “Computers as Components: Principles of Embedded Computing System Design”, Morgan Kaufmann Publisher, Third Edition, 2012.

REFERENCES:

1. M.Senthilkumar, M.Saravanan and S.Jeevananthan, “Microprocessors and Microcontrollers”, Oxford University Press 2013.
2. D.V.Hall, “Microprocessors and Interfacing: Programming and Hardware”, Tata Mc-Graw Hill, 2012.
3. A.K.Ray and K.M.Bhurchandi, “Advanced Microprocessors and Peripherals: Architectures, Programming and Interfacing”, Tata McGraw Hill, Second Edition, 2006.
4. Lyla B. Das, “Embedded Systems: An Integrated Approach”, Pearson Education, 2013.
5. K.V.Shibu, “Introduction to Embedded Systems”, Tata Mc Graw Hill, Second Edition 2017.

20OE303	FUNDAMENTALS OF WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the various wireless communication system.
- To understand the design of a cellular system.
- To study the various digital signaling techniques.
- To study the various multipath mitigation techniques.
- To understand the concepts of multiple antenna techniques.

PRE-REQUISITE: NIL

UNIT - I WIRELESS CHANNELS 9

Evolution of mobile Radio communication networks – Examples of wireless communication systems - Cellular network components - Setting up a call process - Trends in cellular communications: Second Generation networks – Third Generation networks - fourth generation

UNIT - II CELLULAR CONCEPTS 9

Cellular concept - Frequency reuse - channel assignment – hand off Strategies-practical handoff considerations - interference – co channel interference - adjust channel interference - system capacity - Coverage and capacity improvement.

UNIT - III DIGITAL SIGNALLING FOR FADING CHANNELS 9

Linear modulation techniques: binary PSK, DPSK, QPSK - Transmission ,detection - Principles of Offset QPSK- π/4 QPSK - Constant Envelop Modulation - Minimum Shift Keying - Gaussian Minimum Shift Keying.

UNIT - IV MULTIPATH MITIGATION TECHNIQUES 9

Equalization - Linear and Non-Linear equalization - Adaptive equalization - Zero forcing and LMS Algorithms. Diversity - Micro and Macro diversity - Diversity combining techniques - Rake receiver.

UNIT - V MULTIPLE ANTENNA TECHNIQUES 9

MIMO systems - spatial multiplexing - System model - Transmitter Precoding - Beam forming - transmitter diversity - receiver diversity.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Fundamentals of Wireless Communication		**Course Code :** 20OE303
CO	**Course Outcomes**	**K-CO**
1	Explain cellular network evolutions.	K2
2	Explain cellular system based concepts.	K2
3	Identify suitable modulation signaling.	K2
4	Explain the equalization concept for wireless channel.	K3
5	Describe the various diversity techniques to mitigate multipath effect in the wireless channel.	K3
6	Explain the multiple antenna techniques.	K2

TEXT BOOKS:

1. T.S.Rappaport, “Wireless communications”, Pearson Education, Second Edition, 2010.
2. Andreas.F. Molisch, “Wireless Communications”, John Wiley India, 2006.

REFERENCES:

1. Andrea Goldsmith, “Wireless Communication”, Cambridge University Press, 2011.
2. R.Van Nee and Ramji Prasad, “OFDM for wireless multimedia communications”, Artech House, 2000.
3. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
4. Upena Dalal, “Wireless Communication”, Oxford University Press, 2009.

20OE304	SATELLITE COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of satellite orbits.
- To analyze the geo stationary and non geo stationary orbits.
- To acquire the knowledge about launching procedures.
- To study the satellite system engineering, orbital mechanism and effects.
- To study and analysis of multiplexing and multiple access techniques.
- To study and analysis of earth station antenna and equipment.

PRE-REQUISITE: NIL

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 - Link budget calculations - Uplink and Downlink of a satellite link - Atmospheric Losses Interference analysis - Rain induced attenuation and interference - Ionospheric characteristics - Effects - Link Design with and without frequency reuse.

UNIT - IV SATELLITE ACCESS AND CODING METHODS 9

Modulation and Multiplexing: Voice, Data, Video - Analog and digital transmission system - Digital video Broadcast - Multiple access: FDMA, TDMA, CDMA, DAMA Assignment Methods - compression - encryption.

UNIT - V SATELLITE APPLICATIONS 9

INTELSAT Series: INSAT, VSAT. - Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles - Direct Broadcast satellites (DBS/DTH) - Indian Regional Navigation Satellite System (IRNSS).

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Satellite Communication Systems		**Course Code :** 20OE304
CO	**Course Outcomes**	**K-CO**
1	Elaborate the Extended and reusable satellite launching vehicles and launching procedures of satellite systems.	K4
2	Describe about the satellite space segment with various satellite subsystems.	K2
3	Illustrate the satellite Link design with uplink, downlink, rain effects and Ionospheric characteristics.	K2
4	Apply accessing schemes such as TDMA, FDMA and CDMA for satellite communication.	K3
5	Summarize various satellite applications such as Intelsat series and Mobile satellite services.	K2
6	Discuss the LEO, MEO and GEO orbits of satellite and orbital parameters.	K2

TEXT BOOKS:

1. Dennis Roddy, “Satellite Communication”, Mc Graw Hill International, Fourth Edition, 2006.
2. Timothy Pratt, Charles W. Bostain and Jeremy E. Allnutt, “Satellite Communication”, John Wiley & Sons, Second Edition, 2003.

REFERENCES:

1. Wilbur L. Pritchard, Hendri G. Suyderhoud and 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, 1997.
4. Tri T. Ha, “Digital Satellite Communication”, McGraw-Hill Communications Series, Second Edition, 1990.
5. M.Richharia, “Satellite Communication Systems: Design Principles”, Mac Millan, 2003.

20OE305 FUNDAMENTALS OF IMAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression methods.

PRE-REQUISITE: NIL

UNIT - I DIGITAL IMAGE FUNDAMENTALS **9**

Steps in Digital Image Processing - 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.

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.

UNIT - V IMAGE COMPRESSION **9**

Fundamentals of image compression - Compression methods - Huffman Coding, Arithmetic Coding, LZW Coding, Run-Length coding, Symbol-Based Coding, Bit-Plane Coding, Block Transform Coding, Predictive Coding, Wavelet Coding.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Fundamentals of Image Processing		**Course Code :** 20OE305
CO	**Course Outcomes**	**K-CO**
1	Explain the fundamentals of digital image processing techniques.	K4
2	Apply the various transforms and its properties for 2D signals.	K2
3	Describe the various image enhancement technique used in digital image processing.	K2
4	Apply the various filters for image restoration.	K3
5	Examine feature extraction methods for segmentation.	K2
6	Apply the different coding methods for image compression.	K2

TEXT BOOKS:

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Pearson, Third Edition, 2010.
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, Pearson, 2002.

REFERENCES:

1. Kenneth R. Castleman, “Digital Image Processing”, Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods and Steven Eddins, “Digital Image Processing using MATLAB”, Pearson Education, Inc., 2011.
3. D.E. Dudgeon and R.M. Mersereau, “Multidimensional Digital Signal Processing”, Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, “Digital Image Processing”, John Wiley, New York, 2002.
5. Milan Sonka, “Image processing, analysis and machine vision”, Brookes/Cole, Vikas Publishing House, Second Edition, 1999.

20OE306	CONSUMER ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give students an in depth knowledge of various electronic audio and video devices and systems.
- To introduce the consumer electronic gadgets/goods/devices like audio-systems, CD systems.
- To give organization structure and principles of working of various other components like visual display, keyboard drives and printers.
- To find employment in computer industry, repair and maintenance field.

PRE-REQUISITE: NIL

UNIT - I AUDIO SYSTEMS **9**

Microphones, their types: Carbon, velocity, crystal, condenser, cordless etc. Loud Speaker: Direct radiating, horn loaded woofer, tweeter, mid-range, multi-speaker system, baffles and enclosures. Sound recording on magnetic tape, its principles, block diagram and tape transport mechanism, Digital sound recording on tape and disc, CD system, Hi- Fi system, pre-amplifier, amplifier and equalizer system, stereo amplifiers, public address systems, Graphics Equalizer, speed Synthesizer, Electronic tuning.

UNIT - II VIDEO SYSTEMS **9**

B&W TV, color TV and HD TV systems, LCD, LED, PLASMA Systems, Electronic cameras, VCR, VCP, CD systems, Memory diskettes, Discs and drums. Dolby noise reduction digital and analog recording. Digital projection systems (LCD, DLP, SVGA to UXGA system) Block diagram and principles of working of cable TV and DTH, cable TV using internet.

UNIT - III COMPUTER SYSTEM **9**

Different types of mother boards - Single Board Based System - Different types of Buses PCI, ISA, SCSI & Serial and Parallel Ports, USB - Hard Disk Device (HDD) - Computer Monitor - Video Display Adopters - Keyboard - Mouse - Scanner - Printer - digitizer.

UNIT - IV MOBILE PHONE **9**

Architecture - Connectivity - RF Transceiver - Antennas - Tx/Rx switch - Baseband part - System-on-chip - ADC/DAC - Memory and storage - Camera - Sensors - Operating system - Microphone and Speaker - Display and Keypad - Battery.

UNIT - V HOUSEHOLD APPLIANCES **9**

Microwaves: Microwave Oven Block Diagram, LCD Timer with Alarm, Types of Microwave Ovens Washing Machines: Electronic controller for Washing Machines, Washing Machine Hardware, Air Conditioning: Components of Air Conditioning Systems, Remote Control-buttons, Unitary and Central Air Conditioning Systems, Split Air Conditioners. Refrigeration: Refrigerants, Refrigeration Systems, Dish Washers.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Consumer Electronics		**Course Code :** 20OE306
CO	**Course Outcomes**	**K-CO**
1	Describe the various audio system components and its functionalities.	K2
2	Explain the concepts and techniques employed in the construction of televisions.	K2
3	Analyse the construction of personal computers.	K3
4	Illustrate the various blocks and components used in the construction of mobile phones.	K2
5	Explain the various systems used in the residence.	K2
6	Analyse the commonly used consumer electronic gadgets used in our residences.	K3

TEXT BOOKS:

1. Jim Ledin, "Modern Computer Architecture and Organization: Learn x86, ARM, and RISC-V architectures and the design of Smartphones, PCs, and cloud servers", Packt Publishing, Illustrated Edition, 2020.
2. S.P.Bali, "Consumer Electronics", Pearson Education, 2007.

REFERENCES:

1. R.G. Gupta, "Audio and Video Systems: Principles, Maintenance and Troubleshooting", McGraw Hill Education, Second Edition, 2017.
2. Jacob Beckerman, "How to Build a Computer: Learn, Select Parts, Assemble, and Install: A Step by Step Guide to Your First Homebuilt", JIBB Publishing, First Edition, 2014.
3. R.R. Gulati, "Modern Television Practice: Transmission, Reception and Applications", New Age International Private Limited, 2015.
4. Nick Vandome, "Android Phones for Seniors in easy steps: Updated for Android v7 Nougat", In Easy Steps Limited, Second Edition, 2019.
5. Sajid Umair and Muhammad Yousaf Shah, "Mobile Devices and Smart Gadgets in Human Rights", IGI Global, 2018.

20OE307	FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of discrete time systems.
- To learn Discrete Fourier Transform, its properties and its application to linear filtering.
- To understand the characteristics of digital filters, design of FIR and IIR filters and its realization.
- To understand the effects of finite precision representation on digital filters.

PRE-REQUISITE: NIL

UNIT - I DISCRETE TIME SYSTEM ANALYSIS **9**

Classification of discrete time systems - linear, causal, stability, time invariance, dynamic, recursive and non-recursive, Sampling, Nyquist rate, Aliasing effect, Quantization and its error - Discrete Time Fourier Transform, magnitude and phase representation.

UNIT - II DISCRETE FOURIER TRANSFORM **9**

Frequency - Domain sampling: The Discrete Fourier Transform - Properties of DFT - Linear filtering methods based on the DFT - Efficient computation of the DFT: FFT algorithms: radix 2 FFT algorithms.

UNIT - III FINITE IMPULSE RESPONSE FILTERS **9**

Characteristics of practical frequency selective filters - Design of FIR filters: symmetric and Anti-symmetric FIR filters - Design of linear phase FIR filters using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. Structures for FIR systems - linear phase structure, direct form realizations.

UNIT - IV INFINITE IMPULSE RESPONSE FILTERS **9**

Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters: Impulse invariance method, Bilinear transformation. Structure of IIR systems - Direct form structures, Cascade and parallel structures.

UNIT - V FINITE WORD LENGTH EFFECTS **9**

Representation of Numbers - Quantization of filter coefficients - Round-off effects in Digital filters: Limit cycle oscillations in recursive systems - scaling to prevent overflow.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Fundamentals Of Digital Signal Processing		**Course Code :** 20OE307
CO	**Course Outcomes**	**K-CO**
1	Classify the discrete time systems and its frequency response.	K3
2	Compute DFT and IDFT coefficients of a discrete time sequences using FFT algorithms and output of the discrete time system.	K3
3	Determine the transfer function of FIR digital filters.	K3
4	Determine the transfer function of IIR digital filters.	K3
5	Construct the realization structures for digital filters.	K3
6	Explain the fundamental concepts of number representation, quantization errors and limit cycle oscillations.	K2

TEXT BOOKS:

1. John G. Proakis and Dimitris G. Manolakis, “Digital Signal Processing – Principles, Algorithms & Applications”, Pearson Education / Prentics Hall, Fourth Edition, 2016.
2. Sanjay K. Mitra, “Digital Signal Processing: A Computer based approach”, Tata McGraw Hill, Fourth Edition, 2017.

REFERENCES:

1. Emmanuel C. Fleachor and Barrie W. Jervis, “Digital Signal Processing”, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. Vinay K. Ingle and John G. Proakis, “Digital Signal Processing using MATLAB”, Cengage Learning Custom Publications, Third Edition, 2011.
3. A.V. Oppenheim, R.W. Schafer and J.R. Buck, “Discrete – Time Signal Processing”, Indian Reprint, Pearson, Twenty Eight Edition, 2004.
4. Andreas Antoniou, “Digital Signal Processing”, Tata McGraw Hill, 2006.

20OE308	INTRODUCTION TO VLSI TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the VLSI era.
- To introduce the fundamental concepts relevant to VLSI fabrication.
- To enable the students to understand the various VLSI fabrication technique.

PRE-REQUISITE: NIL

UNIT - I LOGIC DESIGN WITH MOSFETS **9**

Ideal Switches and Boolean Operations - MOSFETs as Switches- Basic Logic Gates in CMOS - Complex Logic Gates in CMOS - Transmission Gate Circuits - Clocking and Dataflow Control.

UNIT - II PHYSICAL STRUCTURE OF CMOS INTEGRATED CIRCUITS **9**

Integrated Circuit Layers - Interconnect Resistance and capacitance – MOSFETs - Electrical Conduction in silicon - nFETs and pFETs - Current flow in a FET - driving the gate capacitance - CMOS Layers - Designing FET Arrays.

UNIT - III FABRICATION OF CMOS INTEGRATED CIRCUITS **9**

Overview of Silicon Processing - Material Growth and Deposition - Silicon dioxide - Silicon Nitride - polycrystal silicon – metals - doped silicon layers - chemical mechanical polishing – Lithography - The CMOS Process Flow - Design Rules.

UNIT - IV ELECTRICAL CHARACTERISTICS OF MOSFETS **9**

MOS Physics - derivation of threshold voltage - nFET Current - Voltage Equations - SPICE level 1 equation - body bias effects - derivation of the current flow equation - The FET RC Model - pFET Characteristics - Modeling of Small MOSFET.

UNIT - V ELECTRONIC ANALYSIS OF CMOS LOGIC GATES **9**

DC Characteristics of the CMOS Inverter - Inverter Switching Characteristics - Power Dissipation - DC Characteristics: NAND and NOR Gates - NAND and NOR Transient Response - Analysis of Complex Logic Gates - Gate Design for Transient Performance - Transmission Gates and Pass Transistors.

TOTAL: 45 PERIODS

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Introduction to VLSI Technology		**Course Code :** 20OE308
CO	**Course Outcomes**	**K-CO**
1	Explain the introduction of MOSFET as simple logic controlled switches and then concentrate on the design of CMOS static logic gates at the Boolean level.	K2
2	Generalize the views of an integrated circuit as a set of patterned material layers that are used to control the flow of signals.	K3
3	Discuss the switch level description down to the physical level.	K2
4	Discuss the general and specific aspects of the manufacturing process of CMOS.	K2
5	Derive the equations for RC switching model based on the square law equation.	K3
6	Develop the electrical properties of CMOS logic circuits.	K3

TEXT BOOKS:

1. John P. Uyemura, “Introduction to VLSI Circuits and Systems”, John wiley & sons, 2001.
2. S.K. Gandhi, “VLSI Fabrication Principles”, John Willey & Sons, Second Edition, 2008.

REFERENCES:

1. Kamran Eshraghian, Douglas A. Pucknell and Sholeh Eshraghian, “Essentials of VLSI Circuits and Systems”, PHI, 2005.
2. Neil H.E. Weste and K. Eshraghian, “Principles of CMOS VLSI Design: A System Perspective”, McGraw Hill, 2010.
3. Sung-Mo Kang, Yusuf Lablebici and Chulwookim, “CMOS Digital Integrated Circuits, Analysis and Design”, McGraw Hill, Fourth Edition, 2019.
4. Partha Pratim Sahu, “VLSI Design”, McGraw Hill, 2013.
5. Neil H.E. Weste, “CMOS VLSI Design: A Circuit and System Perspective”, Pearson Education, 2011.