AL-AMEEN ENGINEERING COLLEGE

(Autonomous)

Accredited by NAAC with "A" Grade :: An ISO Certified Institution
(Affiliated to Anna University, Chennai & Approved by AICTE, New Delhi)
Karundevanpalayam, NanjaiUthukkuli Post, Erode – 638 104, Tamilnadu, INDIA.

CURRICULUM & SYLLABI

SEMESTERS – I to VIII

(Regulations 2020)

CHOICE BASED CREDIT SYSTEM

B.E. Electronics and Communication Engineering

Applicable to the Students admitted in the AY 2020-21 only

KNOWLEDGE LEVELS (BLOOM'S TAXONOMY)

Notation	Knowledge Levels
K1	Remembering
K2	Understanding
K3	Applying
K4	Analysing
K5	Evaluating
K6	Creating

VISION
Envisioned to be a centre of academic and research excellence in the field of Electronics and Communication Engineering for uplifting the under-privileged and rural students.

MISSION
1. To provide strong fundamentals and technical skills through effective teaching learning Methodologies. 2. To inculcate learning of emerging technologies in research addressing the needs of industry and society. 3. To create professionals to serve the society with ethical values.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)	
PEO 1	Take up careers in VLSI, Signal Processing, Information and Communication, Embedded system & Control Engineering.
PEO 2	Pursue higher education / research and practice profession.
PEO 3	Adapt to the technological advancement for providing the sustainable engineering solutions to meet organization/society needs.

PROGRAM OUTCOMES (POs)	
PO 1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**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.
PO 3	**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.
PO 4	**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.
PO 5	**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.
PO 6	**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.
PO 7	**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.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**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.
PO 11	**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.
PO 12	**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

PROGRAM SPECIFIC OUTCOMES (PSOs)	
PSO 1	**Professional Competence:** Apply the knowledge of electronics and communication Engineering in VLSI, Signal processing, Information and Communication, Embedded system & Control Engineering.
PSO 2	**Technical Skill:** Design and Implement products using the cutting – edge software and hardware tools.

CURRICULUM

SEMESTER I

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA1T1	Engineering Mathematics I	BS	50	50	3	1	0	4
2	20CY1T2	Engineering Chemistry	BS	50	50	3	0	0	3
3	20EN1T3	Communicative English I	HS	50	50	3	1	0	4
4	20PH1T4	Engineering Physics	BS	50	50	3	0	0	3
5	20CS1T5	Fundamental of Computing and Programming	ES	50	50	3	0	0	3
LABORATORY COURSES									
6	20GE1L1	Physics and Chemistry Laboratory	BS	50	50	0	0	3	1.5
7	20CS1L2	Computer Practices Laboratory	ES	50	50	0	0	3	1.5
MANDATORY COURSE									
8		Universal Human Values 1 - Induction Programme	MC	-	-	-	-	-	-
Total						**15**	**2**	**6**	**20**

SEMESTER II

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA2T1	Engineering Mathematics II	BS	50	50	3	1	0	4
2	20EN2T3	Communicative English II	HS	50	50	3	0	0	3
3	20EC2T4	Electronic Devices and Circuits	ES	50	50	3	0	0	3
4	20EE2T5	Circuit Theory	ES	50	50	3	1	0	4
LABORATORY COURSES									
5	20EM2L1	Engineering Practices Laboratory	ES	50	50	0	0	3	1.5
6	20ME2L2	Engineering Drawing Laboratory	ES	50	50	0	0	3	1.5
7	20EC2L3	Electronic Devices and Circuits Laboratory	ES	50	50	0	0	2	1
MANDATORY COURSE									
8	20CY2T2	Environmental Sciences	MC	100	--	3	0	0	0
Total						**15**	**2**	**8**	**18**

SEMESTER III

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20CS3T1	Data Structures	ES	50	50	3	0	0	3
2	20EC3T2	Signals and Systems	PC	50	50	3	1	0	4
3	20MA3T3	Transforms and Partial Differential Equations	BS	50	50	3	1	0	4
4	20EC3T4	Digital System Design	PC	50	50	3	0	0	3
5	20EE3T5	Principles of Electrical Engineering	ES	50	50	3	0	0	3
LABORATORY COURSES									
6	20ENCL1	Communication Skills Laboratory	HS	50	50	0	0	2	1
7	20EC3L1	Digital System Design Laboratory	PC	50	50	0	0	2	1
8	20CS3L3	Data Structures Laboratory	ES	50	50	0	0	2	1
MANDATORY COURSE									
9	20MCCT1	Constitution of India	MC	100	--	3	0	0	0
Total						**18**	**2**	**6**	**20**

SEMESTER IV

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA4T2	Probability and Random Processes	BS	50	50	3	1	0	4
2	20EC4T3	Linear Integrated Circuits	PC	50	50	3	0	0	3
3	20EC4T4	Microprocessors and Microcontrollers	PC	50	50	3	0	0	3
4	20EC4T5	Electronics Circuits	PC	50	50	3	0	0	3
5	20EC4T6	Electromagnetic Fields	ES	50	50	3	1	0	4
LABORATORY COURSES									
6	20EC4L1	Linear Integrated Circuits Laboratory	PC	50	50	0	0	2	1
7	20EC4L2	Microprocessors and Microcontrollers Laboratory	PC	50	50	0	0	2	1
MANDATORY COURSE									
8	20HSCT1	Universal Human Values 2: Understanding Harmony	HS	100	--	2	1	0	3
Total						**18**	**2**	**4**	**22**

SEMESTER V

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20EC5T1	Digital Signal Processing	PC	50	50	3	1	0	4
2	20EC5T2	Analog and Digital Communication	PC	50	50	3	1	0	4
3		Professional Elective–I	PE	50	50	3	0	0	3
4		Professional Elective- II	PE	50	50	3	0	0	3
5		Open Elective–I	OE	50	50	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENTS									
6	20EE5LT1	Control Systems Engineering	PC	50	50	2	0	4	4
LABORATORY COURSE									
7	20EC5L1	Digital Signal Processing Laboratory	PC	50	50	0	0	3	1.5
MANDATORY COURSE									
8	20PT5T1	Career Guidance - I	MC	100	--	2	1	0	0
Total						**19**	**3**	**7**	**22.5**

SEMESTER VI

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20EC6T1	Antenna and wave Propagation	PC	50	50	3	1	0	4
2	20EC6T2	VLSI Design	PC	50	50	3	1	0	4
3		Professional Elective–III	PE	50	50	3	0	0	3
4		Professional Elective- IV	PE	50	50	3	0	0	3
5		Open Elective–II	OE	50	50	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENTS									
6	20CSCLT1	Data Communication and Networks	PC	50	50	2	0	4	4
LABORATORY COURSE									
7	20EC6L1	VLSI Design Laboratory	PC	50	50	0	0	3	1.5
8	20EC6L2	Mini Project	EEC	100	--	0	0	4	2
MANDATORY COURSE									
9	20PT6T1	Career Guidance - II	MC	100	--	2	1	0	0
Total						**19**	**3**	**11**	**24.5**

SEMESTER VII

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20EC7T1	RF and Microwave Engineering	PC	50	50	3	1	0	4
2	20HSCT2	Professional Ethics	HS	50	50	3	0	0	3
3	20EC7T3	Fiber Optic Communications	PC	50	50	3	1	0	4
4		Open Elective - III	OE	50	50	3	0	0	3
5		Open Elective - IV	OE	50	50	3	0	0	3
THEORY COURSE WITH LABORATORY COMPONENTS									
6	20ECCLT1	Embedded Systems	PC	50	50	2	0	4	4
LABORATORY COURSE									
7	20EC7L1	RF and Microwave Laboratory	PC	50	50	0	0	2	1
8	HX8001	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	100	--	0	0	6	3
Total						**17**	**2**	**12**	**25**

SEMESTER VIII

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
LABORATORY COURSES									
1	20EC8L1	Project Work Phase - II	EEC	50	50	0	0	20	10
2	20EC8L2	Internship / Summer Training	EEC	100	--	0	0	0	1
Total						**0**	**0**	**20**	**11**

Total Credits: 163

(* Total Credits must be 163)

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT (HS)

S. No.	Course Code	Course Title	L	T	P	C
1	20EN1T3	Communicative English - I	3	1	0	4
2	20EN2T3	Communicative English - II	3	0	0	3
3	20ENCL1	Communication Skills Laboratory	0	0	2	1
4	20HSCT1	Universal Human Values 2: Understanding Harmony	3	0	0	3
5	20HSCT2	Professional Ethics	3	0	0	3

BASIC SCIENCES (BS)

Sl.No.	Course Code	Course Title	L	T	P	C
1	20MA1T1	Engineering Mathematics – I	3	1	0	4
2	20CY1T2	Engineering Chemistry	3	0	0	3
3	20PH1T4	Engineering Physics	3	0	0	3
4	20GE1L1	Physics and Chemistry Laboratory	0	0	3	1.5
5	20MA2T1	Engineering Mathematics II	3	1	0	4
6	20MA3T3	Transforms and Partial Differential Equations	3	1	0	4
7	20MA4T2	Probability and Random Processes	3	1	0	4

ENGINEERING SCIENCES (ES)

Sl.No.	Course Code	Course Title	L	T	P	C
1	20CS1T5	Fundamentals of Computing and Programming	3	0	0	3
2	20CS1L2	Computer Practices Laboratory	0	0	3	1.5
3	20EC2T4	Electronic Devices and Circuits	3	0	0	3
4	20EE2T5	Circuit Theory	3	1	0	4

5	20EM2L1	Engineering Practices Laboratory	0	0	3	1.5
6	20ME2L2	Engineering Drawing Laboratory	0	0	3	1.5
7	20EC2L3	Electronic Devices and Circuits Laboratory	0	0	2	1
8	20CS3T1	Data Structures	3	0	0	3
9	20CS3L3	Data Structures Laboratory	0	0	2	1
10	20EE3T5	Principles of Electrical Engineering	3	0	0	3
11	20EC4T5	Electromagnetic Fields	3	1	0	4

PROFESSIONAL CORE (PC)

Sl.No.	Course Code	Course Title	L	T	P	C
1	20EC3T2	Signals and Systems	3	1	0	4
2	20EC3T4	Digital System Design	3	0	0	3
3	20EC3L1	Digital System Design Laboratory	0	0	2	1
4	20EC4T3	Linear Integrated Circuits	3	0	0	3
5	20EC4T4	Microprocessors and Microcontrollers	3	0	0	3
6	20EC4T5	Electronics Circuits	3	0	0	3
7	20EC4L1	Linear Integrated Circuits Laboratory	0	0	2	1
8	20EC4L2	Microprocessors and Microcontrollers Laboratory	0	0	2	1
9	20EC5T1	Digital Signal Processing	3	1	0	4
10	20EC5T2	Analog and Digital Communication	3	1	0	4
11	20EE5LT1	Control Systems Engineering	2	0	4	4
12	20EC5L1	Digital Signal Processing Laboratory	0	0	3	1.5
13	20EC6T1	Antenna and wave Propagation	3	1	0	4

14	20EC6T2	VLSI Design	3	1	0	4
15	20CSCLT1	Data Communication and Networks	2	0	4	4
16	20EC6L1	VLSI Design Laboratory	0	0	3	1.5
17	20EC7T1	RF and Microwave Engineering	3	1	0	4
18	20EC7T3	Fiber Optic Communications	3	1	0	4
19	20ECCLT1	Embedded Systems	2	0	4	4
20	20EC7L1	RF and Microwave Laboratory	0	0	2	1

PROFESSIONAL ELECTIVES (PE)

Semester – V (Elective I)						
Sl.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20EC5E1	Transmission lines and waveguides	3	0	0	3
2	20EC5E2	Optoelectronics Devices	3	0	0	3
3	20EC5E3	Soft Computing	3	0	0	3
4	20EC5E4	Microcontroller Based Automation	3	0	0	3

Semester – V (Elective II)						
Sl.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20EC5E5	Medical Electronics	3	0	0	3
2	20EC5E6	Modern Electronic Instrumentation	3	0	0	3
3	20EC5E7	Electronics Circuit Board Design	3	0	0	3
4	20EC5E8	Advanced Digital Signal Processing	3	0	0	3
5	20EC5E9	Computer Architecture	3	0	0	3

Semester – VI (Elective III)						
Sl.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20ECCE1	Digital Image Processing	3	0	0	3
2	20EC6E3	Fundamentals of Nano Electronics	3	0	0	3
3	20EC6E4	Mobile Communication	3	0	0	3
4	20EC6E5	Cognitive Radio	3	0	0	3
5	20EC6E9	Wireless Broadband Communication	3	0	0	3

Semester – VI (Elective IV)						
Sl.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	20EC6E7	Satellite Communication	3	0	0	3
2	20ECCE2	Wireless Ad hoc and Sensor Networks	3	0	0	3
3	20EC6E8	VLSI Signal Processing	3	0	0	3
4	20ITCE6	Cryptography and Network Security	3	0	0	3
5	20EC6E10	Remote Sensing	3	0	0	3

OPEN ELECTIVES (OE)

Sl.No.	Course Code	Course Title	L	T	P	C
1	20ECO01	Television and Video Engineering	3	0	0	3
2	20ECO02	Sensors and Transducers	3	0	0	3
3	20ECO03	Telecommunication Switching Systems	3	0	0	3
4	20ECO04	Wireless Communication	3	0	0	3
5	20EC6T2	VLSI Design	3	0	0	3
6	20EC7T3	Fiber Optic Communications	3	0	0	3
7	20EC5E2	Optoelectronics Devices	3	0	0	3
8	20EC5E5	Medical Electronics	3	0	0	3
9	20ECCE1	Digital Image Processing	3	0	0	3
10	20EC6E3	Fundamentals of Nano Electronics	3	0	0	3
11	20EC6E7	Satellite Communication	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)
PRACTICAL COURSES AND PROJECT WORK

Sl. No.	Course Code	Course Title	L	T	P	C
1	20ME6L2	Mini Project	0	0	4	2
2	20EC8L2	Internship / Summer Training	0	0	2	1
3	HX8001	Professional Readiness for Innovation, Employability and Entrepreneurship	0	0	6	3
4	20EC8L1	Project Work Phase II	0	0	20	10

MANDATORY COURSES (MC)

Sl.No.	Course Code	Course Title	L	T	P	C
1		Universal Human Values 1 - Induction Programme	0	0	0	0
2	20CY2T2	Environmental Sciences	3	0	0	0
3	20MCCT1	Constitution of India	3	0	0	0
4	20HSCT1	Universal Human Values 2: Understanding Harmony	2	1	0	3
5	20PT5T1	Career Guidance - I	2	1	0	0
6	20PT6T1	Career Guidance - II	2	1	0	0

VALUE ADDED COURSES (VAC)

S.No.	Course Code	Course Title	Credit
1	20ECV01	Basic Electronics Components	1
2	20ECV02	Digital System Design using VHDL	1
3	20ECV03	PCB Design using Cadence EDA Tools	1
4	20ECV04	Embedded System Design using PIC Microcontroller	1
5	20ECV05	Programming using Arduino	1
6	20ECV06	Signal and Image Processing using RaspberryPi	1
7	20ECV07	Embedded System Design using MSP430 and TIVAC Series	1
8	20ECV08	Mobile Phone Servicing	1
9	20ECV09	Basic Networks	1
10	20ECV10	System Design using FPGA	1
11	20ECV11	RF Design using ADS	1

CURRICULUM BREAKDOWN STRUCTURE

Subject	AICTE suggested breakdown of credits	Total number of credits	Curriculum Content (% of total number of credits of the program)
Humanities and Social Sciences including Management (HS)	15	14	8.58
Basic Sciences (BS)	25	23.5	14.41
Engineering Sciences (ES)	24	26.5	16.25
Professional Core (PC)	48	59	36.19
Program Electives (PE)	18	12	7.36
Open Electives (OE)	18	12	7.36
Employability Enhancement Courses (EEC) – Practical Courses and Project Work	15	16	9.81
Mandatory Courses (MC)	0	0	0
Total	**163**	***163**	**100.00**

CREDIT SUMMARY

Sl. No.	Subject Area	Credits per Semester								Total Credits	AICTE Suggested Credits
		I	II	III	IV	V	VI	VII	VIII		
1	**HS**	4	3	1	3			3		14	15
2	**BS**	11.5	4	4	4					23.5	25
3	**ES**	4.5	11	7	4					26.5	24
4	**PC**			8	11	13.5	13.5	13		59	48
5	**PE**					6	6			12	18
6	**OE**					3	3	6		12	18
7	**EEC**						2	3	**11**	16	15
8	**MC**				0					0	0
TOTAL		**20**	**18**	**20**	**22**	**22.5**	**24.5**	**25**	**11**	***163**	**163**

HS – Humanities and Social Sciences including Management
BS – Basic Sciences
ES – Engineering Sciences
PC – Professional Core
PE – Professional Electives
OE – Open Electives
EEC – Employability Enhancement Courses
MC – Mandatory Courses

SEMESTER I

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA1T1	Engineering Mathematics I	BS	50	50	3	1	0	4
2	20CY1T2	Engineering Chemistry	BS	50	50	3	0	0	3
3	20EN1T3	Communicative English I	HS	50	50	3	1	0	4
4	20PH1T4	Engineering Physics	BS	50	50	3	0	0	3
5	20CS1T5	Fundamental of Computing and Programming	ES	50	50	3	0	0	3
LABORATORY COURSES									
6	20GE1L1	Physics and Chemistry Laboratory	BS	50	50	0	0	3	1.5
7	20CS1L2	Computer Practices Laboratory	ES	50	50	0	0	3	1.5
MANDATORY COURSE									
8		Universal Human Values 1 - Induction Programme	MC	-	-	-	-	-	-
Total						**15**	**2**	**6**	**20**

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20MA1T1	ENGINEERING MATHEMATICS I	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Identify Eigen values and Eigenvectors and apply orthogonal diagonalization to convert quadratic form to canonical form.	K3	1
CO2	Apply differentiation and integration technique to solve algebraic and transcendental function	K3	2
CO3	Evaluate the total derivative of the function, expand the given as series and locate the maximum and minimum for multivariate function	K5	3
CO4	Solve first order Ordinary Differential Equations and apply them to certain physical situations	K3	4
CO5	Choose appropriate integral techniques to find area and volume of the given region	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		3				1	3	3		3		
CO2	3	3		3				1	3	3		3		
CO3	3	3		3				1	3	3		3		
CO4	3	3		3				1	3	3		3		
CO5	3	3		3				1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments and Tutorials
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**MATRICES**	**9 + 3**
Eigen values and Eigen vectors of a real matrix – properties of Eigen values and Eigen vectors (without proof) – Cayley-Hamilton theorem (statement and applications) – orthogonal transformation of a symmetric matrix to diagonal form (concept only) – Reduction of quadratic form to canonical form by an orthogonal transformation		
Topic - 2	**DIFFERENTIATION AND INTEGRATION**	**9 + 3**
Basic differentiation formula for algebraic and transcendental functions – derivatives – differentiability rules and properties (without proof) – basic integral formula for algebraic and transcendental functions – integration by parts – partial fraction methods.		
Topic - 3	**FUNCTIONS OF SEVERAL VARIABLES**	**9 + 3**
Total derivatives – Taylor's series expansion – maxima and minima – Lagrange's multipliers method – Jacobian's method		
Topic - 4	**FIRST ORDER ORDINARY DIFFERENTIAL EQUATION**	**9 + 3**
Leibnitz's equations – Bernoulli's equation – equation of first order and higher degree – Clairaut's form – Linear first order differential equations and its applications.		
Topic - 5	**MULTIPLE INTEGRALS**	**9 + 3**
Double integrals: Double integration in Cartesian co-ordinates – change of order of integration – area as a double integration in Cartesian – volume as a triple integral in Cartesian co-ordinates (simple problems)		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Jain R.K and Iyengar S.R.K, "Advanced Engineering Mathematics", 3rd Edition, Narosa Publishing House, New Delhi, Reprint 2009.
2	Ramana B.V., "Higher Engineering Mathematics", Tata Mcgraw Hill Publishing Company, New Delhi, 2008.
3	Kreyszig E., "Advanced Engineering Mathematics", 9th Edition, John Wiley Sons, 2012.
4	Glyn James., "Advanced Modern Engineering Mathematics", Pearson Education Limited, 2007.
5	N P Bali, Manish Goyal, "A Text Book of Engineering Mathematics", 3rd Edition, Laxmi Publication Private Limited, 2009.

OTHER REFERENCES	
1	https://www.slideshare.net/mailrenuka/matrices-and-application-of-matrices
2	https://www.slideshare.net/mailrenuka/matrices-and-application-of-matrices
3	https://youtu.be/wtuq1oSButE
4	https://www.slideshare.net/abhinavsomani3/applications-of-maths-in-our-daily-life-41607055

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20CY1T2	ENGINEERING CHEMISTRY	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the properties & working techniques along with potential applications.	K2	1
CO2	Choose the appropriate method for specific application in engineering technology.	K3	2
CO3	Analyse new solutions to problems in materials and energy usage in daily life	K4	3
CO4	Identify the structure of unknown/new compounds with their properties.	K3	4
CO5	Categorize the important features of various materials and methods for burgeoning society.	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)

COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2					1	3	3		3		
CO2	3	2						1	3	3		3		
CO3	3	2						1	3	3		3		
CO4	3		2					1	3	3		3		
CO5	3	2	2					1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**WATER CHEMISTRY**	**9**
Hardness of water – types – units –boiler troubles (scale and sludge) – treatment of boiler feed water – Internal treatment (phosphate, colloidal, carbonate and calgon conditioning) external treatment – Ion exchange process, zeolite process – desalination of brackish water – Reverse Osmosis.		
Topic - 2	**FUELS AND COMBUSTION**	**9**
Fuels: Introduction - classification of fuels – Combustion- coal – Analysis of coal - carbonization - manufacture of metallurgical coke (Otto Hoffmann method) - petroleum - knocking - octane number - diesel oil - cetane number - natural gas - compressed natural gas (CNG) - liquefied petroleum gases (LPG) - power alcohol.		
Topic - 3	**ENERGY STORAGE DEVICES**	**9**
Batteries - Types of batteries – primary battery - dry cell. Secondary battery - lead acid battery, Nickel- Cadmium battery, fuel cells – Hydrogen -Oxygen fuel cell. - Solar energy conversion - solar cells – Application.		
Topic - 4	**SPECTROSCOPY**	**9**
Introduction – Laws of spectroscopy - Block diagram, Instrumentation, Working and application of Visible spectroscopy and Ultra Violet spectroscopy – Infrared spectroscopy – Flame photometry – Atomic adsorption spectroscopy.		
Topic - 5	**ENGINEERING MATERIALS**	**9**
Polymer – Types of polymerization – Preparation, properties, uses of Nylon(6,6), Poly Vinyl Chloride (PVC). Plastics – Types - Rubbers – SBR – Nanomaterial – Synthesis and its applications of Nanomaterial. Abrasives – Classification, Properties- Manufacture of SiC.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	S.S Dara and S.S. Umare ‘Engineering Chemistry’, S.Chand Publication, 2013
2	Jain & Jain ‘Engineering chemistry’ Dhanpat Rai Publishing Company, 2012
3	Shikha Agarwal , Engineering Chemistry, Cambridge University Press, 2015 edition
4	Manas Senapati, Advanced Engineering Chemistry, Firewall Media, 2006

OTHER REFERENCES	
1	https://www.freebookcentre.net/chemistry-books-download
2	https://nptel.ac.in/course.html
3	https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/polymers.htm
4	https://edu.rsc.org/resources/collections/analytical-chemistry-introductions

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20EN1T3	COMMUNICATIVE ENGLISH I	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the rules of grammar to parts of speech, tenses, voices, degrees of comparison, compound nouns and articles	K3	1
CO2	Interpret graphical representation for composing passages and paraphrase technical texts	K4	2
CO3	Analyze different spoken discourses like, short talks, comprehend different dialogues, practice conversation for speaking skills	K4	3
CO4	Examine grammatical errors using correct vocabulary and generating ideas logically on a topic	K5	4
CO5	Develop language and vocabulary effectively for our real life contexts	K6	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3			2	3		3		
CO2						2			2	3		2		
CO3						3			2	2		1		
CO4						2			2	3		2		
CO5						3			1	3		2		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Grammar Quizzes
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**GRAMMAR AND VOCABULARY**	**9 + 3**
Word formation with Prefix and Suffix – Parts of Speech – Tenses - Voices – Degrees of comparison –Compound Nouns - Basic Vocabulary – Homonyms and Homophones – Articles- Idioms – Phrasal verbs– Subject-Verb Agreement.		
Topic - 2	**LISTENING**	**9 + 3**
Introduction to Listening – Listening Comprehension – Extensive and Intensive listening – Pronunciation– Intonation – Stress – Pause – Rhythm – Short and Long conversations.		
Topic - 3	**SPEAKING**	**9 + 3**
An introduction to Speech sounds – Verbal and Non-verbal Communication – Describing places, people, Technical Processes – Telephonic skills – Different types of Interview – Group Discussions – Debates.		
Topic - 4	**READING**	**9 + 3**
Skimming and Scanning – Reading Newspaper articles – Reading different types of texts – Speed Reading – Reading to identify Stylistic Features (Syntax, Lexis, Sentence Structures) – Comprehension.		
Topic - 5	**WRITING**	**9 + 3**
Introduction to aspects of technical writing – Letter writing – Formal Letters – Job application letter with CV and Resume - Official letters- Business letters- Circular letters- Employment letters – Punctuation – Writing reviews on books and movies – recommendations – Creative writing – email writing.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Board of Editors, Using English, Orient Black Swan, 2015.
2	Practical English Usage, Michael Swan, OUP 1995.
3	Communicative English, J.Anbazhagan Vijay, Global Publishers – Chennai 2018.
4	Effective Communication, Adair, John. London: Pan Macmillan Ltd., 2003.
5	Brilliant Communication Skills, Hasson, Gill. Great Britain: Pearson Education, 2012.

OTHER REFERENCES	
1	http://networketiquette.net/
2	http://www.englishdaily626.com/c-errors.php
3	http://www.dailywritingtips.com/

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20PH1T4	ENGINEERING PHYSICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Classify the extensive properties of solid materials to use in current field.	K2	1
CO2	Identify and develop the knowledge of atoms in solid crystals to apply recent engineering fields.	K3	2
CO3	Describe the fundamentals of lasers, laser systems, their characteristics and diversified applications including industry and medicine.	K4	3
CO4	Demonstrate a mastery of the core knowledge base in thermal physics.	K3	4
CO5	Evaluate the nano materials and it's fabrication with behaviour by using advanced technical methods.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			1	3	2	3	3	3	3	3		
CO2	2	1				3	2	3	3	3	3	3		
CO3	3	2	2			3	2	3	3	3	3	3		
CO4	2					3	2	3	3	3	3	3		
CO5	3	2				3	2	3	3	3	3	3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini Project
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**PROPERTIES OF MATTER**	**9**
Hooke's Law - Stress-Strain Diagram - Elastic moduli - Poisson's Ratio - Expression for bending moment of beam and depression of Cantilever - Expression for Young's modulus by Non-uniform bending and its experimental determination.		
Topic - 2	**CRYSTAL PHYSICS**	**9**
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - growth of single crystals: solution and melt growth techniques.		
Topic - 3	**LASER TECHNOLOGY**	**9**
Introduction – principle of spontaneous emission and stimulated emission, population inversion, pumping mechanism. Laser characteristics - Einstein's A and B coefficients derivation. Two, three and four level systems. Threshold gain coefficient- Component of laser. Solid state laser (Nd:YAG). Diode lasers –Application of laser in science and engineering.		
Topic - 4	**THERMAL PHYSICS**	**9**
Transfer of heat energy - thermal conduction, convection and radiation – heat conductions in solids – thermal conductivity - Lee's disc method - theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.		
Topic - 5	**NANO TECHNOLOGY**	**9**
Introduction to Nano materials- Moore's law- Properties of Nano materials- Quantum well, wire and dot- Fullerene, Carbon Nanotubes- Application of Nanotechnology in industry.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Serway and Jewett, "Physics for Scientists and Engineers with Modern Physics", 6th Edition, Thomson Brooks Cole, 2008
2	Charles P. Poole and Frank J.Owens, "Introduction to Nanotechnology", 2nd Edition, Wiley, Delhi, 2008.
3	S.O. Pillai, "Solid state Physics", 6th Edition, New Age International Publishers, 2008.

OTHER REFERENCES	
1	https://nptel.ac.in/courses/115/105/115105099/
2	https://nptel.ac.in/courses/115/106/115106061/
3	https://www.youtube.com/watch?v=_JOchLyNO_w
4	https://www.journals.elsevier.com › Journals
5	https://nptel.ac.in/courses/118/104/118104008/

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20CS1T5	FUNDAMENTALS OF COMPUTING AND PROGRAMMING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the word processing tools with text documents	K2	1
CO2	Organize spreadsheet manipulation tools with sheets also describe the presentation and sliding with layouts	K3	2
CO3	Develop C program using managing input and output operations.	K6	3
CO4	Design array and string implementation in C	K6	4
CO5	Evaluate the function and structure concepts in C	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3				3		3					2		
CO2	3		2		2							2		
CO3	3		2		3									
CO4	3		2		2							2		
CO5	3											2		
CO6	3				2							3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO MS-WORD AND MS-EXCEL**	**9**
Introduction to word – Creating, editing, saving and printing text documents - Font and paragraph formatting - Simple character formatting -Inserting tables, smart art, page breaks -Using lists and styles-Working with images -Using Spelling and Grammar check -Understanding document properties Introduction to Spreadsheet basics - Creating, editing, saving and printing spreadsheets -Working with functions & formulas -Modifying worksheets with color & autoformats -Graphically representing data : Charts & Graphs - Data Menu, Subtotal, Filtering Data -Formatting worksheets -Securing & Protecting spreadsheets		
Topic - 2	**MS-POWERPOINT AND INTERNET**	**9**
Introduction to Powerpoint- Opening, viewing, creating, and printing slides -Applying auto layouts -Adding custom animation -Using slide transitions -Graphically representing data : Charts & Graphs -Creating Professional Slide for Presentation. Internet - Understanding how to search/Google -bookmarking and Going to a specific website -Copy and paste Internet content into your word file and emails -Understanding social media platforms such as Facebook & Many more -learn with best practices		
Topic - 3	**C PROGRAMMING BASICS**	**9**
Problem formulation – Problem Solving - Introduction to ‘ C’ programming –fundamentals – structure of a ‘C’ program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in ‘C’ – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.		
Topic - 4	**ARRAYS AND STRINGS**	**9**
Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.		
Topic - 5	**FUNCTIONS, STRUCTURES AND UNIONS**	**9**
Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion - Structure – need for structure data type – structure definition – Structure declaration – Structure within a structure - Union - Programs using structures and Unions – Storage classes, Pre-processor directives.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Microsoft Office 2010 In Depth 1st Edition by Joe Habraken (Author) ,2010
2	Byron S Gottfried, “Programming with C”, Schaum’s Outlines, Second Edition, Tata McGraw-Hill,2006.
3	“Computer basics absolute beginners”9thEdition, Michale Miller,2019

OTHER REFERENCES	
1	https://youtu.be/ZXAPCy2c33o
2	https://courses.lumenlearning.com/wm-compapp/chapter/internet-and-powerpoint/
3	https://www.geeksforgeeks.org/c-language-set-1-introduction/
4	https://www.studytonight.com/c/string-and-character-array.php
5	https://www.geeksforgeeks.org/difference-structure-union-c/

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20GE1L1	PHYSICS & CHEMISTRY LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	Compare the physical characteristics of given solid materials.	K3
CO2	Calibrate the velocity of ultrasonic waves through water medium.	K3
CO3	Survey the optical property of light sources.	K4
CO4	Analyse the nature of the hardness, chloride level, pollution level using DO content in water sample.	K4
CO5	Apply potential and conductometric measurements for quantitative and qualitative analysis.	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	2	-	-	2	3	3	-	2	-	-
CO2	2	2	2	3	2	-	-	2	3	3	-	2	-	-
CO3	2	2	2	3	2	-	-	2	3	3	-	2	-	-
CO4	2	2	2	1	2	1	-	2	3	3	-	2	-	-
CO5	2	2	2	1	2	1	-	2	3	3	-	2	-	-

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
PHYSICS LABORATORY **(Any Five Experiments)**	
1	Torsional pendulum - determination of moment of inertia and rigidity modulus
2	Determination of young's modulus by non- uniform bending
3	(a) Determination of Wavelength, and particle size using Laser (b) Determination of acceptance angle in an optical fiber.
4	Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
5	Air wedge – determination of thickness of a thin wire.
6	Determination of band gap of a semiconductor.
LIST OF EXPERIMENTS	
CHEMISTRY LABORATORY **(Any Five Experiments)**	
1	Determination of total, temporary and permanent hardness of water by EDTA method.
2	Estimate the dissolved oxygen content of the given water sample by Winkler's method.
3	Determine the chloride content of the given potassium chloride sample using standardized silver nitrate solution.
4	Determination of iron content of the given solution using a potentiometer
5	Determination of strength of acid using conductivity meter.
6	Using conductance measurements, determine the strength of acids in a mixture.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**30**		**TOTAL**	**45**

BOOK REFERENCES	
1	C. Ramesh Kumar & Y. Devakumari, "Physics Laboratory Manual", Al-Ameen Publications, 2020.
2	N. Jafarulla & C. Krishna Moorthy C "Chemistry Laboratory Manual", Al-Ameen Publications, 2020.

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20CS1L2	COMPUTER PRACTICES LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	Assembling and Dissembling parts of a computer.	K3
CO2	Develop documents, presentation, and computation using MS-office.	K3
CO3	Develop computer programs using different types of operator and expressions in C.	K4
CO4	Implement programs with arrays and strings.	K4
CO5	Create programs using structure, union and functions.	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	-	1	2	3	3	-	3	-	-
CO2	3	2	2	2	1	-	1	2	3	3	-	3	-	-
CO3	3	3	3	2	1	-	1	2	3	3	-	3	-	-
CO4	3	3	3	2	2	-	1	2	3	3	2	3	-	-
CO5	3	3	3	2	2	-	1	2	3	3	2	3	-	-

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Study Experiment a) Hardware specification and PC Assembly b) Getting connected to internet
2	Word processing a) Documentation creation, Text Manipulation with scientific notation b) Table Creation, Table Formatting and Conversion c) Mail Merge d) Flow Chart Preparation.
3	Spread Sheet a) Charts- Bar Chart, Pie Chart, Line Chart, X,Y-Chart b) Object Inclusion, Picture and Graphics c) Protecting the Document
4	Power Point Presentation and Access a) Creation of Presentation b) Generation of Report Using Access
5	C Programming a) Simple C Program with Data Types, Expressions and Comment Lines b) Programming with Conditional Statements c) Programming with Branching and Looping Statements d) Programming with Arrays and String e) Programming with Function and Structure

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	Computer Practices Laboratory manual, Al - Ameen Publications 2020
2	Microsoft Office 2008 In Depth 2nd Edition by Joe (Author) , 2010

OTHER REFERENCES	
1	https://youtu.be/ftyWKjT20S4
2	https://nptel.ac.in/about_nptel.html
3	https://nptel.ac.in/courses/106/106/106106092/

SEMESTER II

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA2T1	Engineering Mathematics II	BS	50	50	3	1	0	4
2	20EN2T3	Communicative English II	HS	50	50	3	0	0	3
3	20EC2T4	Electronic Devices and Circuits	ES	50	50	3	0	0	3
4	20EE2T5	Circuit Theory	ES	50	50	3	1	0	4
LABORATORY COURSES									
5	20EM2L1	Engineering Practices Laboratory	ES	50	50	0	0	3	1.5
6	20ME2L2	Engineering Drawing Laboratory	ES	50	50	0	0	3	1.5
7	20EC2L3	Electronic Devices and Circuits Laboratory	ES	50	50	0	0	2	1
MANDATORY COURSE									
8	20CY2T2	Environmental Sciences	MC	100	--	3	0	0	0
Total						**15**	**2**	**8**	**18**

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., Common to all	20MA2T1	ENGINEERING MATHEMATICS II	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Solve higher order differential equations and apply them to certain physical situations	K3	1
CO2	Apply various integral theorems for solving engineering problems involving cubes and parallelepipeds.	K3	2
CO3	Solve linear differential equations using Laplace transform techniques.	K3	3
CO4	Construct analytic function of complex variables and transform functions from z- plane to w- plane and vice-versa using conformal mappings. .	K3	4
CO5	Apply the techniques of complex integration to evaluate real and complex integrals over suitable closed paths or contours	K3	5

PRE-REQUISITE	Engineering Mathematics I

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		3				1	3	3		3		
CO2	3	3		3				1	3	3		3		
CO3	3	3		3				1	3	3		3		
CO4	3	3		3				1	3	3		3		
CO5	3	3		3				1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments and Tutorials
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**SECOND AND HIGHER ORDER ORDINARY DIFFERENTIAL EQUATIONS**	**9 + 3**
Second order linear differential equations with constant co-efficient – Cauchy equation – Euler equation– Cauchy – Legendre equation– Method of variation of parameters– Solution of simultaneous equation with constant coefficients		
Topic - 2	**VECTOR CALCULUS**	**9 + 3**
Introduction– gradient–directional derivative–divergence and curl–angel between the surfaces–solenoidal and irrotational vector fields–Green's theorem in a plane–Gauss divergence theorem–Stoke's theorem (without proof).		
Topic - 3	**LAPLACE TRANSFORMS**	**9 + 3**
Condition for existence– Transform of elementary function– Basic properties(without proof)– Derivatives and integrals of transforms– Transform of unit step function– Initial and final value theorem(statement only)– Transform of a periodic function– Inverse Laplace transform– Partial fractions method–convolution theorem(statement only)– Solution of linear ODE of second order with constant co-efficients.		
Topic - 4	**ANALYTIC FUNCTIONS**	**9 + 3**
Analytic function – Necessary and sufficient condition – Cauchy Rieman equation (without proof) – Properties of analytic function (statement only) – Harmonic function – Constructions of analytic function – Bilinear transformation – Conformal mappings $w = z + a,\ w = az,\ w = \frac{1}{z}$		
Topic - 5	**COMPLEX INTEGRATION**	**9 + 3**
Cauchy's integral theorem (without proof) –Cauchy integral formula –Taylor's and Laurent's series (without proof) – Singularities –Cauchy's residue theorem – Contour Integration: Circular and Semi circular contour (excluding polar on real axis).		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	GrewalB.S., "Higher Engineering Mathematics", 42nd Edition,Khanna Publications New Delhi, 2011
2	JainR.K and Iyengar S.R.K, "Advanced Engineering Mathematics",4th Edition, NarosaPublishing House, New Delhi, Reprint 2014.
3	Ramana B.V., "Higher Engineering Mathematics",Tata Mcgraw Hill Publishing Company, New Delhi, 2011.
4	Kreyszig E., "Advanced Engineering Mathematics", 10th Edition, John Wiley Sons, 2010..

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=GSpbh94-Cjo
2	https://www.slideshare.net/RazwanulGhani/application-ofdifferentialequationinreallife
3	https://www.slideshare.net/poojithchowdhary/applications-of-analytic-functions-and-vector-calculus
4	https://slideplayer.com/slide/15496011/

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., Common to all (Except Civil)	20EN2T3	COMMUNICATIVE ENGLISH II	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Initiate and sustain a discussion maintaining appropriate group behaviour, for a given communication scenario.	K5	1
CO2	Speak effectively and express opinions clearly for a given communicative context.	K3	2
CO3	Read different technical and professional texts, infer implied meanings and critically analyse evaluate the ideas presented.	K4	3
CO4	Use functional grammar for improving employment-oriented skills. Use appropriate vocabulary and grammatical forms to complete a passage.	K3	4
CO5	Comprehend different spoken experts critically and infer spoken and implied meaning.	K6	5

PRE-REQUISITE	Communicative English I

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3			3	3		3		
CO2						2			3	3		3		
CO3						3			3	3		3		
CO4						2			3	3		3		
CO5						3			3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Grammar Quizzes
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1		**9**
Listening: Listening practice – different types of conversation and answering questions – gap exercises Speaking: Introduce one self and others – Opening a conversation Reading: Reading a novel, itinerary, Magazine and News papers Writing: Formal Letters – Job application letter with CV and Resume Grammar: Kinds of Sentences – Sentence Pattern (Parts/ Patterns/ Column Analysis).		
Topic - 2		**9**
Listening: Short texts – Listening to situation based dialogues – Listening to talks on engineering - Speaking: Sharing information of a personal kind – greeting – taking leave– Reading: Comprehension Questions (multiple choice questions and short questions) – short narrative stories - Writing: Paragraph Writing – Filling Forms – Basics of Business writing – Placing Orders, Letter of Complaint - Grammar: Asking Questions in the Simple Present – Using reference words, Yes/No type questions.		
Topic - 3		**9**
Listening: Listening to academic lectures and live speech – advertisements and announcements –Speaking: Giving and Justifying opinions – apologizing – Introduction to Presentation – Reading: Reading Blogs – Website articles – Paragraphing – Writing: Tweets – Texting and SMS language – Use of Sequence Words - Grammar: Using Past Tense to make correct sentences – WH questions.		
Topic - 4		**9**
Listening: Listening to a telephone conversation – Documentaries and making notes – Speaking: Giving Instructions – Role play – Asking about routine actions – Reading: Reading detailed comprehension - Writing: Writing Reports – Preparing Checklist - Grammar: Make sentences from Future Tense and their Usages (Compare the sentences with Degrees of Comparison).		
Topic - 5		**9**
Listening: Viewing a model group discussion and reviewing the performance of each participant – Casual Conversation - Speaking: Participating in a Group Discussion – Speeches for special Occasions– Reading: Making notes from long passage or any form of written materials – providing a suitable title – Writing: Brainstorming – Writing short essays - Grammar: Numerical Adjectives – Misspelled Words – Direct and Indirect speech – Spot the Errors.		

THEORY	**45**		**TUTORIAL**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Dr. Elango et al. “Resonance: English for Engineers and Technologist”, Foundation, Chennai, 2013.
2	Anderson, Paul V., “Technical Communication: A Reader-Centered Approach”, Cengage.
3	Sharma, Sangeetha and Binod Mishra**,** “Communication Skills for Engineers and Scientists”, PHI Learning , New Delhi, 2009.
4	“Exercises in Spoken English Part I –III”. EFLU, Hyderabad, OUP, 2014.
5	Raman, Meenakshi, & Sangeeta Sharma. Technical Communication: Principles and Practice, Second Edition. New Delhi: Oxford University Press, 2011.

OTHER REFERENCES	
1	http://www.owlnet.rice.edu/
2	http://zzyx.ucsc.edu/archer/intro.html
3	http://www.indiabix.com/group-discussion/topics-with-answers/

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. ECE	20EC2T4	ELECTRONIC DEVICES AND CIRCUITS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Demonstrate and articulate the concepts related to Semiconductor diodes and Special diodes	K2	1
CO2	Apply the various types of DC Power Supplies.	K3	2
CO3	Analyze the Bipolar Transistors and its performance	K4	3
CO4	Analyze the Field Effect Transistors to infer its limitations	K4	4
CO5	Evaluate a situation based application and recommend a suitable Integrated Circuit Fabrication	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2											3		1
CO2	3	2	2		2					3		2		1
CO3	3	2	3			2		2			2			
CO4	3	2	2	2			3		2			2		3
CO5	2	2												

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**SEMICONDUCTOR DIODES AND SPECIAL DIODES**	**9**
Semiconductor diodes: Formation of PN junction – working principle – VI characteristics – PN diode currents – Diode current equation – Diode resistance – transition and Diffusion capacitance – Diode models – voltage breakdown in diodes. Special purpose diodes: Zener diode – Point-contact diode – Backward diode – Varactor diode – Step- recovery diode – Schottky diode, PNPN diode – RF diode – Tunnel diode- Gunn diode - Avalanche diode - Laser diode.		
Topic - 2	**DC POWER SUPPLIES**	**9**
Half Wave Rectifier - Precision Half Wave Rectifier, Full wave Rectifier- bridge rectifier- Rectifiers with filter capacitors - Clippers and Clampers - Voltage multipliers - Voltage regulators: voltage regulation - Zener diode shunt regulator - transistor series regulator - transistor shunt regulator - switching regulators - design of complete DC power supply circuit		
Topic - 3	**BIPOLAR TRANSISTORS**	**9**
Bipolar Transistors: Construction – working – transistor currents –transistor configurations and input-output characteristics – Early effect (base width modulation) – Ebers Moll model – transistor as an amplifier –Transistor as a switch.		
Topic - 4	**FIELD EFFECT TRANSISTORS**	**9**
Field-Effect Transistors: construction, working and VI characteristics of JFET – comparison of BJT and JFET – MOSFET – enhancement MOSFET, depletion MOSFET, their working principle and VI characteristics, comparison of MOSFET with JFET, comparison of D MOSFET with E - MOSFET,CMOS, MESFET, CCD. Frequency response: Low frequency response of BJT and FET amplifiers –Miller effect capacitance – high frequency response of BJT and FET amplifiers.		
Topic - 5	**INTEGRATED CIRCUIT FABRICATION**	**9**
Integrated circuit – advantages and drawback of ICs – scale of integration – classification of ICs – definition of linear IC and digital IC with examples – manufacturing process of monolithic ICs – fabrication of components (diode, capacitor, bipolar transistor and resistor) on monolithic IC – comparison of MOS ICs and bipolar ICs.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Millman, Christos C Halkias, Satyabrata Jit, “Electron Devices and Circuits”, Tata McGraw Hill, 4th Edition ,2015
2	Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, Pearson Education,11th Edition, 2015
3	Thomas L. Floyd, “Electronic Devices”, 9th edition, Pearson Education, 2012
4	David A Bell, “Fundamentals of Electronic Devices and Circuits”, Fifth edition Oxford Press, 2009.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=qqQ8wO-lNmI
2	https://www.youtube.com/watch?v=usmdrcB_BFA
3	https://www.youtube.com/watch?v=Rx43l-QpeWQ
4	https://www.youtube.com/watch?v=zHjohO646FE
5	https://www.youtube.com/watch?v=sTwRQDVHNiw

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. ECE	20EE2T5	CIRCUIT THEORY	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Demonstrate the basic concepts related to electrical circuits / Networks.	K2	1
CO2	Apply the Laws / Rules of circuits in electrical networks.	K3	2
CO3	Compare electrical networks to rate its performance.	K4	3
CO4	Analyze electrical networks to infer their limitations.	K4	4
CO5	Evaluate a network based on a set of criteria / application and recommend a suitable electrical system.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2		1	3	3		3		2
CO2	3	3	3	2	2			1	3	3		3		2
CO3	3	3	3		2			1	3	3		3		
CO4	3	3	3	2	2			1	3	3		3		
CO5	3	3	3	2	2			1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**BASIC CIRCUITS ANALYSIS**	**12**
Fundamentals of Electrical Engineering - Ohm's Law –Kirchoff's Law – DC & AC Circuits –Resistors in series and parallel circuits – Mesh current and node voltage analysis for DC & AC Circuits.		
Topic - 2	**NETWORK REDUCTION AND THEOREMS**	**12**
Network reduction: voltage and current division – source transformation – Star delta conversion – Thevenins and Norton Theorems – Superposition Theorem – Maximum power transfer theorem.		
Topic - 3	**TRANSIENT RESPONSE ANALYSIS**	**12**
Basic R, L and C elements -Transient response of RL, RC and RLC Circuits using Laplace transform for DC input and A.C. sinusoidal input– Two port Networks– Z & Y parameters.		
Topic - 4	**RESONANCE AND COUPLED CIRCUITS**	**12**
Series and parallel resonance – Frequency response – Quality factor and Bandwidth – Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.		
Topic - 5	**THREE PHASE CIRCUITS**	**12**
A.C. circuits – Power, Power Factor and Energy– Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced& un-balanced – power measurement in three phase circuits.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Ramesh Babu, " Circuit Analysis", Scitech Publications, Bangalore, 6Th Edition, 2017.
2	Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", McGraw Hill, 2015.
3	Richard C. Dorf and James A. Svoboda, "Introduction to Electric Circuits", 7th Edition, John Wiley & Sons, Inc. 2015.
4	Mahadevan, K., Chitra, C., "Electric Circuits Analysis," Prentice-Hall of India Pvt Ltd., New Delhi, 2015.
5	Rao, " Electrical Circuit Analysis", Cengage Publications, New Delhi, 2013.

OTHER REFERENCES	
1	https://youtu.be/5hFC9ugTGLs
2	https://youtu.be/zs4MnEx7wTQ
3	https://youtu.be/shJAV59NS6k
4	https://youtu.be/zXMQeIpUzhQ
5	https://youtu.be/mc979OhitAg

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E./B.Tech (Common to all)	20EM2L1	ENGINEERING PRACTICES LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	Develop the carpentry components and plumbing works for the basic machining operations.	K3
CO2	Concatenate the structures by using welding equipments.	K3
CO3	Analyze and do all household electrical works.	K4
CO4	Design and construct different electronics application circuits.	K4
CO5	Test simple electronic circuits and component on PCB by soldering and assembling respectively.	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1	1	-	2	3	3	1	2	-	-
CO2	3	3	1	1	1	1	-	2	3	3	1	2	-	-
CO3	3	3	2	3	3	2	-	2	3	3	1	2	-	-
CO4	3	3	2	3	3	2	-	2	3	3	1	2	-	-
CO5	3	3	1	3	2	1	-	2	3	3	1	2	-	-

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	**GROUP A (CIVIL & MECHANICAL) I. CIVIL ENGINEERING PRACTICE** **Buildings:** 1. Study of plumbing and carpentry components of residential and industrial buildings safety aspects. **Plumbing Works:** 1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings. 2. Preparation of plumbing line sketches for water supply and sewage works. 3. Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components. 4. Demonstration of plumbing requirements of high-rise buildings. **Carpentry using manual and power tools:** 1. Study of the joints in roofs, doors, windows and furniture. 2. Hands-on-exercise: Wood work, joints by sawing, planning and cutting.
2	**II.MECHANICAL ENGINEERING PRACTICE** **Welding:** 1. Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding. 2. Gas welding practice **Basic Machining:** 1. Simple Turning and Taper turning 2. Drilling Practice **Sheet Metal Work:** 1. Forming & Bending 2. Model making – Trays and funnels. 3. Different type of joints. **Machine Study practice:** 1. Study of centrifugal pump 2. Study of air conditioner
3	**GROUP B (ELECTRICAL AND ELECTRONICS)** **III.ELECTRICAL ENGINEERING PRACTICE** 1. Testing and connection of Fluorescent lamp wiring. 2. Stair case wiring. 3. Measurement of energy using single phase energy meter. 4. Assembly of Residential house wiring. 5. Measurement of earth resistance of an electrical equipment using meggar.
4	**IV.ELECTRONICS ENGINEERING PRACTICE** 1. Resistor colour coding & Measurement of AC signal parameters (Peak-Peak, RMS period, Frequency) using CRO. 2. Study of logic gates AND, OR, EX-OR and NOT. 3. Measurement of ripple factor of HWR and FWR. 4. Soldering practice for Components, Devices and Circuits. **5.** Generation of Clock Signal.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**45**		**TOTAL**	**45**

BOOK REFERENCES	
1	"Engineering Practices Laboratory", Al-Ameen Publications, 2020.
OTHER REFERENCES	
1	https://www.youtube.com/watch?v=UE3XlSwcpEI
2	https://www.youtube.com/watch?v=lk2MwtiEL0k
3	https://www.youtube.com/watch?v=v2XnYVYDyWA
4	https://www.youtube.com/watch?v=tCpChoMWhjE
5	https://www.youtube.com/watch?v=lk2MwtiEL0k

Semester	Programme	Course Code	Course Name	L	T	P	C
I	B.E. / B.Tech., Common to all	20ME2L2	ENGINEERING DRAWING LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	Identify the drawing instruments effectively and able to dimension the figure.	K3
CO2	Appraise the usage of engineering curves in tracing the path of simple machine components.	K3
CO3	Interpret the concept of projection and acquire visualization skills, projection of points.	K4
CO4	Construct the basic views related to projections of lines, planes.	K4
CO5	Plan to use the modern tool for drawing communication.	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
Cos	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3	3	3	3	2	3	3	1	2	-	1
CO2	3	3	2	3	3	3	2	2	3	3	1	2	-	1
CO3	2	3	3	3	3	3	2	2	3	3	1	2	-	1
CO4	2	2	2	3	3	3	2	2	3	3	1	2	-	1
CO5	3	2	2	3	3	3	3	2	3	3	1	2	-	1

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Drawing the problems based on Orthographic projection using Software Package
2	Drawing the problems based on Orthographic projection using Software Package
3	Drawing the problems based on Orthographic projection using Software Package
4	Drawing the problems based on Orthographic projection using Software Package
5	Drawing the problems based on Isometric projection using Software Package
6	Detailed Study Of Drawing sheet, Drawing Board, Drawing Instruments.
7	Detailed Study Of Dimensioning, Arrow Head , Lettering

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	R.K. Dhawan, "A text book of Engineering Drawing" ,S.Chand Publishers, Delhi,2010.
2	Dhananjay. A.Jolhe, " Engineering Drawing with an introduction to AutoCAD", TataMcGrawHill Publishing Company Ltd., Delhi,2008.
3	BasantAgarwal and Agarwal.C.M., "Engineering Drawing"Tata McGrawHill Publishing Company Ltd., Delhi,2008.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=IUwkSNvuBZE
2	https://www.youtube.com/watch?v=nLVnYHbW39E
3	https://www.youtube.com/watch?v=Pdu8kPKT6Cs
4	https://www.youtube.com/watch?v=gXX6TJT6Urk
5	https://www.youtube.com/watch?v=Y4gsOdYpiVQ

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. ECE	20EC2L3	ELECTRONIC DEVICES AND CIRCUITS LABORATORY	0	0	2	1

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	Analyze the characteristics of different Diode	K3
CO2	Analyze various transistor configurations	K3
CO3	Design and Testing of BJT and MOSFET amplifiers	K4
CO4	Analyzing Rectifier Circuits and Voltage Regulators	K4
CO5	Understand the concepts of simulation by using Spice/ Multisim Tool	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
Cos	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	1	-	1	3	3	1	2	2	1
CO2	3	3	2	2	-	1	-	1	3	3	1	2	2	1
CO3	3	2	3	3	-	2	-	1	3	3	1	2	2	1
CO4	3	3	2	2	-	1	-	1	3	3	1	2	2	1
CO5	2	2	2	2	3	-	-	1	3	3	1	2	2	1

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Characteristics of PN junction and Zener diode
2	Input, Output and Transfer characteristics of CE Configuration
3	Input, Output and Transfer characteristics of CC Configuration.
4	Characteristics of LDR, Photo-diode and Phototransistor.
5	Transfer characteristics of JFET
6	Transfer characteristics of MOSFET. (With depletion and enhancement mode)
7	Characteristics of LED with three different wavelengths.
8	Half wave rectifier, Full wave rectifier and Full wave Bridge rectifier with and without capacitive filter.
9	Series voltage Regulator
10	Simulation experiments 1, 2,3,5,6 using PSPICE or Multisim.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**30**		**TOTAL**	**30**

BOOK REFERENCES	
1	Electronic Devices and Circuits Manual, Al-Ameen Publications, 2020.

OTHER REFERENCES	
1	https://youtu.be/56fIDi-AwY4
2	https://youtu.be/32K7YjawjYI
3	https://youtu.be/J6BAUYE6mfs
4	https://youtu.be/SheW7HjDAUg
5	https://youtu.be/FbvDMetY

Semester	Programme	Course Code	Course Name	L	T	P	C
II	B.E. / B.Tech., Common to all	20CY2T2	ENVIRONMENTAL SCIENCES	3	0	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Demonstrate the importance of interdisciplinary nature of environment and health risk assessment.	K2	1
CO2	Discuss the ecosystem and their importance in the environment and conservation of biodiversity.	K2	2
CO3	Design the rain water harvesting system in their living area.	K6	3
CO4	Analyze the impact of pollution and hazardous waste in a global and societal context.	K4	4
CO5	Understand contemporary issues that result in environmental degradation that would attempt to provide solutions to overcome the problems.	K3	5

PRE-REQUISITE	Engineering Chemistry

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1					2	1	3	3		3		
CO2	2	2					1	1	3	3		3		
CO3	3	1	1					1	3	3		3		
CO4	3	2	1					1	3	3		3		
CO5	3	1					2	1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**ENVIRONMENT AND ECOSYSTEMS**	**9**
Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs – Introduction, types, characteristic features, structure and function of the forest ecosystem aquatic ecosystems (ponds, river and marine). Activity: Study of the ecosystem structure in Cauvery River.		
Topic - 2	**BIODIVERSITY**	**9**
Introduction to biodiversity definition: genetic, species and ecosystem diversity –value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – In-situ and ex- situ conservation of biodiversity. Activity: Study of common plants, insects, birds.		
Topic - 3	**ENVIRONMENTAL POLLUTION**	**9**
Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Thermal pollution (d) Noise pollution – solid waste management: causes, effects and control measures of municipal solid wastes – Hazardous and biomedical waste management -pollution case studies. Activity: Study of air and water pollution in industry.		
Topic - 4	**NATURAL RESOURCES**	**9**
Forest resources: over-exploitation, deforestation, – Water resources: Rain water harvesting-watershed management - utilization of surface and ground water, conflicts over water, dams-benefits and problems Food resources: effects of modern agriculture, fertilizer-pesticide problems - Principles of Green Chemistry- Case studies Activity: Tree plantation and maintenance within the campus.		
Topic - 5	**SUSTAINABILITY AND POPULATION**	**9**
From unsustainable to sustainable development – environmental Impact Assessment (EIA) – environmental ethics: Issues and possible solutions – climate change, acid rain, ozone layer depletion, and case studies – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act - environment and human health – value education – HIV / AIDS – women and child welfare. Activity: Small group meetings about environment and human health in local area peoples and making poster and short films about HIV / AIDS – women and child welfare.		

THEORY	**45**		**TUTORIAL**	**00**		**PRACTICAL**	**00**		**TOTAL**	**45**

BOOK REFERENCES	
1	Erach Bharucha,"Textbook of Environmental Studies", Universities Press(I) Pvt, Ltd, Hydrabad,2015.
2	Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
3	Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill Education, 2014.

OTHER REFERENCES	
1	https://www.onlinebiologynotes.com/food-chain-food-web-and-ecological-pyramids/
2	https://vikaspedia.in/energy/environment/biodiversity-1/conservation-of-biodiversity
3	https://www.sciencedirect.com/topics/earth-and-planetary-sciences/ozone-layer-depletion

SEMESTER III

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20CS3T1	Data Structures	ES	50	50	3	0	0	3
2	20EC3T2	Signals and Systems	PC	50	50	3	1	0	4
3	20MA3T3	Transforms and Partial Differential Equations	BS	50	50	3	1	0	4
4	20EC3T4	Digital System Design	PC	50	50	3	0	0	3
5	20EE3T5	Principles of Electrical Engineering	ES	50	50	3	0	0	3
LABORATORY COURSES									
6	20ENCL1	Communication Skills Laboratory	HS	50	50	0	0	2	1
7	20EC3L1	Digital System Design Laboratory	PC	50	50	0	0	2	1
8	20CS3L3	Data Structures Laboratory	ES	50	50	0	0	2	1
MANDATORY COURSE									
9	20MCCT1	Constitution of India	MC	100	--	3	0	0	0
Total						**18**	**2**	**6**	**20**

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E.ECE	20CS3T1	DATA STRUCTURES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the time complexity of various algorithms.	K4	1
CO2	Define and use stack, queue Abstract Data Types and Tree ADT.	K1	2
CO3	Explain Tree and Graph Traversals.	K4	3
CO4	Use shortest Path Algorithm and minimum spanning Tree algorithms.	K3	4
CO5	Explain Sorting technique and its types	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3			1	3	3		3	2	2
CO2	3	3	3	2	2			1	3	3		3	2	
CO3	3	3	3	2				1	3	3		3	2	
CO4	3	3	3	2				1	3	3		3	2	
CO5	3	3	3	3	2			1	3	3		3	2	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic-1	**INTRODUCTION AND ABSTRCT DATA TYPES**	**9**
Algorithm Analysis: Calculation of Running Time – Abstract Data Type-List ADT: Array implementation of List, Linked Lists, Doubly Linked List, and Circularly Linked Lists.		
Topic-2	**STACK AND QUEUE ADT**	**9**
Stack ADT: Stack Model, Implementation of stacks, Applications: Balancing Symbols, Postfix expression evaluation, Infix to postfix conversion, Function Calls–Queue ADT: Queue Model, Implementation of Queues, Applications.		
Topic-3	**TREE ADT**	**9**
Preliminaries –Implementation of Trees–Tree Traversals– Binary Tree Implementation, Expression Tree–Search Tree ADT–AVL Trees, Rotation for Height Balancing– BTrees – Red Black Trees.		
Topic-4	**GRAPH ALGORITHMS**	**9**
Definitions– Representation of Graphs–Traversal-Topological sort– Shortest Path Algorithm's Dijkstra's Algorithm –Network Flow Problem–Minimum Spanning Tree: Prim's and Kruskal's algorithm.		
Topic-5	**SORTING**	**9**
Insertion Sort– Shell Sort –Heap Sort –Merge Sort –Quick Sort–Bucket Sort–External Sorting: Simple Algorithm, Multi way merge, Poly Phase Merge.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Thomas H. Cormen , Charles E. Leiseron, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, PHI learning Pvt. Ltd.,2011.
2	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C" Second Edition, PearsonEducation Limited, 2002.
3	SartajSahni, "Data Structures, Algorithms and applications in C++", Second Edition, Universities Press,2005.

OTHER REFERENCES	
1	https://nptel.ac.in/courses/106/105/106105034/
2	https://www.youtube.com/watch?v=6XTYoZymbwE
3	https://www.youtube.com/watch?v=MP6VlAE_7WY

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. ECE	20EC3T2	SIGNALS AND SYSTEMS	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the concepts of Signals and Systems	K2	1
CO2	Apply the concepts of Fourier series and Fourier transform in Continuous time Signals	K3	2
CO3	Apply the concepts of Laplace transform in LTI Continuous time systems	K3	3
CO4	Apply the concepts of Discrete Time Fourier Transform & Z Transform in Discrete Time signals	K3	4
CO5	Apply the concepts of Discrete Time Fourier Transform & Z Transform in LTI Discrete Time systems	K3	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2			1	3	3		3		
CO2	3	2	2	1	2			1	3	3		3		
CO3	3	1		1	2			1	3	3		3		
CO4	1	3	2	2	1			1	3	3		3	2	
CO5	1	1	2	3	2			1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO SIGNALS AND SYSTEMS**	**9 + 3**
Introduction to Continuous Time (CT) signals and Discrete Time (DT) signals - step, ramp, impulse, exponential, sinusoidal signals, Representation of DT signals by impulses- signal operations classification of CT and DT signals – periodic and aperiodic signals, random signals, energy and power signals, even and odd signals - linear time invariant CT systems and DT systems- basic system properties: linear time invariant, causality, BIBO stability.		
Topic - 2	**ANALYSIS OF CONTINUOUS TIME SIGNALS**	**9 + 3**
Fourier series analysis- spectrum of Continuous Time signals- properties of continuous time Fourier series, Fourier transform of continuous time aperiodic signals and periodic signals, properties of continuous time Fourier transform. Fourier and Laplace Transforms in signal Analysis.		
Topic - 3	**LINEAR TIME INVARIANT–CONTINUOUS TIME SYSTEMS**	**9 + 3**
Differential Equation- CT system representations by differential equations -Block diagram representation-impulse response, convolution integrals- Frequency response of systems characterized by Differential Equations- Fourier and Laplace transforms in Analysis- state space representation.		
Topic - 4	**ANALYSIS OF DISCRETE TIME SIGNALS**	**9 + 3**
Baseband Sampling of CT signals- Aliasing, Reconstruction of CT signal from DT signal, Discrete Time Fourier series representation of DT periodic signals – Properties – Representation of DT a periodic signalsby Discrete Time Fourier Transform (DTFT) – Properties – Z Transforms properties.		
Topic - 5	**LINEAR TIME INVARIANT –DISCRETE TIME SYSTEMS**	**9 + 3**
Difference Equations-Block diagram representation-Impulse response-Convolution sum -DTFT and Z Transform analysis of Recursive & Non-Recursive systems – Frequency response of systems characterized by Difference –Equations-state space representation. Applications: Introduction to SCI Lab and MATLAB Tools.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

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

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=s8rsR_TStaA&list=PLBlnK6fEyqRhG6s3jYIU48CqsT5cyiDTO
2	https://www.youtube.com/watch?v=up55tuwestg&list=PLWPirh4EWFpHr_1ZCkuF9ToYUrmujv9Aa
3	https://www.youtube.com/watch?v=ftKIWPBMWKs&list=PL9RcWoqXmzaIG-RWneeqDJ-FCt66S15pl
4	https://www.youtube.com/watch?v=-FHm2pQmiSM&list=PLUl4u3cNGP61kdPAOC7CzFjJZ8f1eMUxs
5	https://www.youtube.com/watch?v=H-R_ZT0IPwY&list=PLgzsL8klq6DJGMumdc_n80bw0nDNgsSas

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E.,EEE , ECE & MECH	20MA3T3	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Solve partial differential equations and apply them to certain physical situations	K3	1
CO2	Choose the appropriate methods related to Fourier series to solve the problems based on periodic and non periodic functions.	K6	2
CO3	Classify the PDE and use Fourier series techniques to find the solutions of one dimensional wave and heat equations.	K3	3
CO4	Analyse the situation and select an appropriate techniques for solving problems based on Fourier transforms.	K4	4
CO5	Evaluate Z-transform and estimate inverse Z-transform of certain functions and use it to solve difference equations	K5	5

PRE-REQUISITE	Engineering Mathematics I & Engineering Mathematics II

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		3				1	2	3		3		
CO2	3	3		3				1	2	3		3		
CO3	3	3		3				1	2	3		3		
CO4	3	3		3				1	2	3		3		
CO5	3	3		3				1	2	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments and Tutorials
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**PARTIAL DIFFERENTIAL EQUATIONS**	**9 + 3**
Formation of partial differential equations- Solutions of standard types of first order partial differential equations- Lagrange's linear equation- Linear partial differential equations of second and higher order with constant coefficients of homogeneous type.		
Topic - 2	**FOURIER SERIES**	**9 + 3**
Dirichlet's conditions- General Fourier series- Odd and even functions- Half range sine series- Half range cosine series- Parseval's identity- Harmonic analysis.		
Topic - 3	**APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**	**9 + 3**
Classification of PDE- Method of separation of variables- Fourier series solutions of one dimensional wave equation- One dimensional equation of heat conduction- Steady state solution of two dimensional equation of heat conduction		
Topic - 4	**FOURIER TRANSFORMS**	**9 + 3**
Statement of Fourier integral theorem- Fourier transform pair- Fourier sine and cosine transforms- Properties (statement only)- Transforms of simple functions- Convolution theorem (without proof)- Parseval's identity.		
Topic - 5	**Z TRANSFORMS AND DIFFERENCE EQUATIONS**	**9 + 3**
Z-transforms- Elementary properties (statement only)- Inverse Z-transform (using partial fractions and residues)- Initial and final value theorems- Convolution theorem (without proof)- Formation of difference equations-Solution of difference equations using Z-transform.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Jain .R.K And Iyengar S.R.K,"Advanced Engineering Mathematics",3rd Edition, Narosa Publishing House, New Delhi , Reprint 2009
2	Ramana B.V., "Higher Engineering Mathematics",Tata Mcgraw Hill Publishing Company, New Delhi, 2008
3	Kreyszig.E.,"Advanced engineering mathematics', 9th Edition , John Wiley Sons , 2012
4	Glyn James., "Advanecd Modern Engineering Mathematics", Pearson Education Limited, 2007

OTHER REFERENCES	
1	https://byjus.com/maths/differential-equations-applications/
2	https://www.analyzemath.com/calculus/Differential_Equations/applications.html
3	https://math.stackexchange.com/questions/579453/real-world-application-of-fourier-series
4	https://www.slideshare.net/zakilivebuzz/math-presentation-by-syed-ahmed-zaki
5	https://cadcammodelling.wordpress.com/2011/04/14/fourier-transform-and-its-applications/

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. ECE	20EC3T4	DIGITAL SYSTEM DESIGN	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the Boolean algebra and K map to design the circuits.	K3	1
CO2	Detailed Knowledge and implementation of Combinational logic circuits.	K2	2
CO3	Ability to analyze and design Synchronous digital circuits.	K4	3
CO4	Create the state machine model to design asynchronous sequential circuits	K5	4
CO5	Knowledge on different memory and programmable logic devices	K3	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2		3	2			1	3	3		3		
CO2	1	2		2	2			1	3	3		3		
CO3	1	2		3	2			1	3	3		3		
CO4	1	2		2	2			1	3	3		3		
CO5	2	2		1	2			1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini Project
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**BINARY CODES AND BOOLEAN ALGEBRA**	**9**
Binary, BCD, Grey Codes - ASCII and Error Detecting Codes - Boolean Algebra - Boolean functions - Canonical and Standard Forms - Minimization of Boolean expressions - Karnaugh map minimization - Don't care conditions - Tabulation Method - Implementation of logic functions using Gates - NAND and NOR implementation- Variable entered k- map.		
Topic - 2	**COMBINATIONAL LOGIC CIRCUITS**	**9**
Binary Adder - Binary Subtractor - BCD Adder - Binary Multiplier - Magnitude Comparator - Multiplexer/Demultiplexer - Decoder/Encoder - Code converters – Parity generator and checker.		
Topic - 3	**SYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS**	**9**
Latches - Flip flops - Analysis and Design of Clocked Sequential Circuits – State Reduction and State Assignment - Ripple Counters: Binary, BCD, Modulo n, Up/Down counters - Shift registers:- Universal Shift Register–Synchronous counters - Ring counter – Johnson counter .		
Topic - 4	**ASYNCHRONOUS SEQUENTIAL CIRCUITS**	**9**
Block Diagram - Modes of Operation – Analysis of Asynchronous Sequential Circuits - Design of Asynchronous Sequential Circuits - Reduction of Flow Tables - Races – Hazards.		
Topic - 5	**MEMORY AND PROGRAMMING LOGIC**	**9**
Classification of Memories - RAM organization - Memory decoding - Memory expansion – Static RAM cell - Dynamic RAM cell - ROM organization - Types of ROM - Programmable Logic Array - Programmable Array Logic - Field Programmable Gate Arrays.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Stephen Brown, ZvonkoVranesic, "Fundamentals of Digital Logic with Verilog Design", 2nd Edition, Tata McGraw Hill Education Pvt.Ltd., 2010.
2	A.Anand Kumar, "Fundamentals of Digital Circuits", 3rd Edition, PHI Learning Pvt. Ltd, New Delhi, 2014
3	Charles H.Roth, Jr, "Fundamentals of Logic Design", 7th Edition, Jaico Publishing House, 2013.Donald D.Givone

OTHER REFERENCES	
1	http://www.ee.surrey.ac.uk/Projects/Labview/minimisation/tabular.html
2	https://youtu.be/_yHo2qq82P0
3	https://youtu.be/SzV4l0_1MCQ
4	https://youtu.be/AaN72s5WfOM
5	https://youtu.be/iaIu5SYmWVM

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. - ECE	20EE3T5	PRINCIPLES OF ELECTRICAL ENGINEERING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Construct and explain the operation of DC machines.	K3	1
CO2	Analyze the construction, operation and characteristics of AC Machines.	K4	2
CO3	Conclude the knowledge of transformer to industrial applications.	K5	3
CO4	Analyze the performance of DC & AC Starters for specific applications.	K4	4
CO5	Compare the starting methods & speed control techniques of DC and AC motors.	K5	5

PRE-REQUISITE	CIRCUIT THEORY

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2			2		1	3	3		3		
CO2		2			2			1	3	3		3		
CO3	3			2	3			1	3	3		3		
CO4	3	2						1	3	3		3		
CO5	2			2				1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**DC MACHINES**	**9**
DC Generator: Construction & Principle of operation- EMF equation- Types –Characteristics – Applications. DC Motor: Construction & Principle of operation - Back EMF - Types – Characteristics - Applications.		
Topic - 2	**AC MACHINES**	**9**
Construction, Principle of Operation of AC Generators (Sailent & Non Sailent), Synchronous motor, Single and three phase induction Motors.		
Topic - 3	**TRANSFORMERS**	**9**
Single Phase transformer: Construction & principle of operation- EMF Equation- Ideal transformer- Auto transformer -Three Phase transformer Connections.		
Topic - 4	**STARTING METHODS**	**9**
Types of DC Motor starters (Two point, Three point & Four point) –Soft starter - Three phase squirrel cage and slip ring induction motors. (DOL Starter, Auto Transformer Starter, Rotor resistance Starter and Star/Delta Starter)		
Topic - 5	**CONVENTIONAL AND SOLID STATE SPEED CONTROL OF DC & AC DRIVES**	**9**
Armature and field control, Ward Leonard Scheme, Single phase rectifier controllers (half and Full), Slip power recovery scheme, Single phase voltage regulator.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	A.K.Shawney, “A Course in Electrical and Electronics Measurements & Instrumentation”, DhanpatRai & Co. 2010.
2	Bhattacharya, “Electrical Machines”, Tata McGraw Hill, 2013.
3	Bakshi, “Electrical Machines –II”, Technical Publications , Pune, 2015.
4	Dubey, “Fundamental of Electrical Drives”, Narosa Publications, New Delhi, 2011.

OTHER REFERENCES	
1	**https://www.youtube.com/watch?v=Vd2UJiIPbag**

Semester	Programme	Course Code	Course Name	L	T	P	C
II,III & IV	B.E. / B.Tech., Common to all	20ENCL1	COMMUNICATION SKILLS LABORATORY	0	0	2	1

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment/exercise in the Communication Skills Laboratory Course.	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment/exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	3	3	-	-	-	-
CO2	3	-	-	-	3	-	-	2	3	-	1	-	-	-
CO3	3	2	-	2	-	1	-	-	-	3	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	3	-	1	-	-

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Laboratory Practice Sessions

2	Conversation Practice Sessions (To be done as real life interactions)
3	Group Discussion Sessions
4	Interview Sessions
5	Presentation

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**30**		**TOTAL**	**30**

BOOK REFERENCES	
1	Baul Emmerson and Nick Hamilton, 'Five Minute Activities for Business English', Cambridge University Press, New York, 2005.
2	Arthur Brookes and Peter Grundy, 'Beginning to Write: Writing Activities for Elementary and Intermediate Learners', Cambridge University Press, New York, 2003.
3	George, Livingston. 'Using Communication Skills Lab in Enhancing Speaking Skills of Engineering Students' 2018.
4	Nira Konar: English Language Laboratory: A Comprehensive Manual, PHI Learning, 2011.
5	Pandey, Dr.Meenu. 'A Practical Book of Communication Skills', NIRALI Prakashan advancement of knowledge, second edition 2018.

OTHER REFERENCES	
1	Khan Academy Videos on English Speaking and Writing
2	https://learningenglish.britishcouncil.org/en/listening
3	Adrian Duff et.al. (ed.): Cambridge Skills for Fluency
4	Mark Hancock: English Pronunciation in Use
5	Audio Cassettes/CD'S OUP 2004

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. - ECE	20EC3L1	DIGITAL SYSTEM DESIGN LABORATORY	0	0	2	1

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Digital System Design Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally -	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	0	0	0	-	0	3	3	-	-	-	-
CO2	3	-	-	0	3	0	-	2	3	0	1	-	-	-
CO3	3	2	-	2	0	1	-	0	0	3	-	-	-	-
CO4	3	-	-	0	0	0	-	0	0	3	-	-	-	-
CO5	3	-	-	0	0	0	-	0	0	3	-	1	-	-

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Verification of Boolean Theorems using basic gates.
2	Design and implementation of combinational circuits using basic gates for arbitrary functions,code converters.
3	Design and implement of Half/Full Adder and Subtractor.
4	Design and implement of combinational circuits using MSI devices: (i) 4 – bit binary adder / subtractor. (ii) Parity generator / checker (iii) Magnitude Comparator (iv) Application using multiplexers
5	Design and implement of shift-registers
6	Design and implement of synchronous counters.
7	Design and implement of asynchronous counters.
8	Design and implementation of Mod-N Counter
9	Coding combinational circuits and sequential circuits using VHDL (For Experiment 2, 3, 4, 5, 6 and 7).
10	Design and implementation of a simple digital system. (Mini Project)

THEORY	0		TUTORIAL	0		PRACTICAL	30		TOTAL	30

BOOK REFERENCES	
1	Digital System Design Laboratory Manual, Al-Ameen Publications, 2022

OTHER REFERENCES	
1	https://youtu.be/oNh6V91zdPY
2	https://youtu.be/CeD2L6KbtVM
3	https://youtu.be/zok4iU9YJiE
4	https://youtu.be/oNh6V91zdPY
5	https://youtu.be/Mt3AToASuFo

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. ECE	20CS3L3	DATA STRUCTURES LABORATORY	0	0	2	1

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		**RBT Level**
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Data Structures Laboratory Course.-	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise.	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally.	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions.	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication.	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	3	3	-	-	-	-
CO2	3	-	-	-	3	-	-	2	3	-	1	-	-	-
CO3	3	2	-	2	-	1	-	-	-	3	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	3	-	1	-	-

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Implementing sorting algorithms – selection sort, insertion sort, quick sort
2	Implementing Set operations using Linked List
3	Implementing stack using array and Linked List
4	Implementing stack applications (Balancing Parenthesis, Infix to postfix conversion)
5	Implementing queue applications (Job scheduling- FIFO, Round Robin)
6	Implementing priority queue
7	Implementing Binary Search trees
8	Implementing AVL trees
9	Implementing BFS and DFS algorithms

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**30**		**TOTAL**	**30**

BOOK REFERENCES	
1	"Data Structures Laboratory Manual", Al-Ameen Publications 2022**.**

OTHER REFERENCES	
1	http://enggedu.com/data_structure_lab_exercise_programs/index.php
2	https://www.slideshare.net/ayeshasaifbhatti/ds-lab-handouts
3	https://mrcet.com/pdf/Lab%20Manuals/CSE/DATA%20STRUCTURES%20LAB.pdf

Semester	Programme	Course Code	Course Name	L	T	P	C
III	B.E. /B. Tech. Common to All	20MCCT1	CONSTITUTION OF INDIA	3	0	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand and abide the rules of the Indian constitution.	K2	1
CO2	Applying the functions of Central government.	K2	2
CO3	Applying the function of state government.	K2	3
CO4	Evaluate the various constitutional functions.	K2	4
CO5	Explain the different culture among the people of India	K2	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2	2	2	3	3		3		1
CO2						1	2	2	3	3		3		1
CO3						1	2	2	3	3		3		1
CO4						1	2	2	3	3		3		1
CO5						1	2	2	3	3		3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Role of the Election Commission.		
Topic - 2	**STRUCTURE AND FUNCTION OF CENTRAL AND STATE GOVERNMENT**	**9**
Union Government – Structures of the Union Government and Functions – President – Vice President– Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review. State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.		
Topic - 3	**CONSTITUTION FUNCTIONS OF INDIA AND INDIAN SOCIETY**	**9**
Indian Federal System – Central – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India. Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections		
Topic - 4	**POLICIES AND ACTS – GENERAL**	**9**
Insurance and Bonding – Laws Governing Sale, Purchase and use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax , Excise and Custom duties and their Influence on Construction Cost – Legal Requirements for Planning – Property Law– Agency Law – Local Government Laws for Approval.		
Topic - 5	**POLICIES AND ACTS ON INFRASTRUCTURE DEVELOPMENT**	**9**
A Historical Review of the Government Policies on Infrastructure – Current Public Policies on Transportations – Power and telecom Sector – Plans for Infrastructure Development – Legal framework for Regulating Private Participation in Roads and Highways – Ports and Airport and Telecom		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Durga Das Basu, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi,2018.
2	R.C.Agarwal, "Indian Political System", S.Chand and Company, New Delhi, 2004
3	Maciver and Page, "Society: An Introduction Analysis", Mac Milan India Ltd., New Delhi,2007
4	K.L.Sharma, "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi,2006.

OTHER REFERENCES	
1	https://nptel.ac.in/courses/106/105/106105034/
2	https://www.youtube.com/watch?v=6XTYoZymbwE
3	https://www.youtube.com/watch?v=MP6VlAE_7WY

SEMESTER IV

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20MA4T2	Probability and Random Processes	BS	50	50	3	1	0	4
2	20EC4T3	Linear Integrated Circuits	PC	50	50	3	0	0	3
3	20EC4T4	Microprocessors and Microcontrollers	PC	50	50	3	0	0	3
4	20EC4T5	Electronics Circuits	PC	50	50	3	0	0	3
5	20EC4T6	Electromagnetic Fields	ES	50	50	3	1	0	4
LABORATORY COURSES									
6	20EC4L1	Linear Integrated Circuits Laboratory	PC	50	50	0	0	2	1
7	20EC4L2	Microprocessors and Microcontrollers Laboratory	PC	50	50	0	0	2	1
MANDATORY COURSE									
8	20HSCT1	Universal Human Values 2: Understanding Harmony	HS	100	--	2	1	0	3
Total						**18**	**2**	**4**	**22**

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E. ECE	20MA4T2	PROBABILITY AND RANDOM PROCESSES	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Relate and apply the concept of probability and random variables and predict probabilities of events in models following normal distribution.	K3	1
CO2	Identify the types of correlation, correlation between variables, and predict unknown values using regression.	K3	2
CO3	Classify different types of random processes and use it to find whether it is SSS or WSS.	K2	3
CO4	Analyse correlation related to various random processes and establish the properties of spectral densities,	K4	4
CO5	Analyse linear time invariant systems performance for random inputs.	K4	5

PRE-REQUISITE	Engineering Mathematics I , Engineering Mathematics II & Transforms and Partial Differential Equations

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		3				1	3	3		3		
CO2	3	3		3				1	3	3		3		2
CO3	3	3		3				1	3	3		3		
CO4	3	3		3				1	3	3		3		2
CO5	3	3		3				1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments and Tutorials
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**PROBABILITY AND RANDOM VARIABLES**	**9 + 3**
Basic concepts of probability – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Exponential and Normal distributions.		
Topic - 2	**TWO – DIMENSIONAL RANDOM VARIABLES**	**9 + 3**
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (statement only).		
Topic - 3	**RANDOM PROCESSES**	**9 + 3**
Classification – Stationary process – Markov process - Markov chain - Poisson process – Random telegraph process.		
Topic - 4	**CORRELATION AND SPECTRAL DENSITIES**	**9 + 3**
Auto correlation functions – Cross correlation functions – Properties – Power spectral density Cross spectral density – Properties.		
Topic - 5	**LINEAR SYSTEMS WITH RANDOM INPUTS**	**9 + 3**
Linear time invariant system – System transfer function – Linear systems with random inputs–Auto correlation and cross correlation functions of input and output		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Cooper. G.R., McGillem. C.D., "Probabilistic Methods of Signal and System Analysis", Oxford University Press, New Delhi, 3rd Indian Edition, 2012.
2	Miller. S.L. and Childers. D.G., — "Probability and Random Processes with Applications to Signal Processing and Communications ", Academic Press, 2013.
3	Peebles, P.Z., "Probability, Random Variables and Random Signal Principles ", Tata McGraw Hill, 4th Edition, New Delhi, 2011.
4	Oliver . C. Lbe., "Fundamentals of applied probability and random processes" Academic Press, 2007.

OTHER REFERENCES	
1	https://www.cuemath.com/learn/mathematics/probability-in-real-life/
2	https://sciencing.com/examples-of-real-life-probability-12746354.html
3	http://www.iraj.in/journal/journal_file/journal_pdf/14-358-149822091462-64.pdf

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E. ECE	20EC4T3	LINEAR INTEGRATED CIRCUITS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Demonstrate and articulate the basic structure of operational amplifiers and itscharacteristics.	K2	1
CO2	Characterize and analyze the applications of op-amp.	K3	2
CO3	Design waveform generators and PLL using operational amplifier.	K6	3
CO4	Analyze the concept of IC based voltage regulator and signal conversioncircuits	K4	4
CO5	Examine the different types of A/D and D/A converters.	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2							1	3	3		3		
CO2	3	2	2		2			1	3	3		3		
CO3	3	2	3					1	3	3		3		
CO4	3	2	2					1	3	3		3		
CO5	3	2						1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini Project
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**OPERATIONAL AMPLIFIER CHARACTERISTICS**	**9**
Op-amp symbol, terminals, packages and specifications, Block diagram Representation of op-amp- Ideal op-amp & practical op-amp - Open loop & closed loop configurations, DC & AC performance characteristics of op-amp, Frequency response and compensation, Basic op-amp internal schematic, Review of data sheet of an op-amp.		
Topic - 2	**OP–AMP APPLICATIONS**	**9**
Basic op-amp circuits: Inverting & Non-inverting voltage amplifiers, Voltage follower, Summing, scaling & averaging amplifiers, AC amplifiers, Linear Applications: Instrumentation Amplifiers, V-to-I and I-to-V converters, Differentiators and Integrators. Non-linear Applications: Precision Rectifiers, Wave Shaping Circuits (Clipper and Clampers), Log and Antilog Amplifiers, Comparators and its applications.		
Topic - 3	**WAVEFORM GENERATORS AND PLL**	**9**
Waveform Generators: Sine-wave Generators, Triangle / Saw-tooth Wave generators. IC 555 Timer: Monostable operation and its applications, Astable operation and its applications, VCO, PLL and its operations.		
Topic - 4	**VOLTAGE REGULATOR IC's**	**9**
Voltage Regulators: Basics of Voltage Regulator, Linear Voltage Regulators using Op-amp, IC Regulators (78xx, 79xx, LM 317, LM 337, 723), Switching Regulators., IC273Voltage regulator, IC 18038 Function Genrator.		
Topic - 5	**DATA CONVERSION DEVICES**	**9**
Digital to Analog Conversion: DAC Specifications, Weighted Resistor DAC, R-2R Ladder DAC and Inverted R-2R Ladder DAC, Monolithic DAC, Analog to Digital conversion: ADC specifications, Successive Approximation ADC, Dual Slope ADC, Flash Type ADC, Monolithic ADC.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Ramakant A.Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th Edition, Prentice Hall, 2015.
2	David A. Bell, "Operational Amplifiers and Linear ICs", 3rd edition, OUP, 2013.
3	Roy Choudhury and Shail Jain, "Linear Integrated Circuits", 4th Edition, New Age InternationalPublishers, 2014.
4	Robert F. Coughlin, Frederick F. Driscoll, "Operational-Amplifiers and Linear Integrated Circuits",6th Edition, Prentice Hall, 2001.
5	Bakshi, " Linear Integrated Circuits and Applications", Technical Publications, Chennai, 2016.
6	Sergio Franco, "Design with operational amplifier and analog integrated circuits", McGraw Hill,1997.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=Y1KE8eAC9Bk
2	https://www.youtube.com/watch?v=kiiA6WTCQn0
3	https://www.youtube.com/watch?v=Uc2R7GND0Dk
4	https://www.youtube.com/watch?v=icxvLWEOzEA
5	https://www.youtube.com/watch?v=PzbdTfUatIY

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E. ECE	20EC4T4	MICROPROCESSOR AND MICROCONTROLLER	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Describe the basic concept of 8086 microprocessor architecture	K2	1
CO2	Generalize the system bus architecture of 8086 microprocessor	K3	2
CO3	Examine the I/O peripheral interface of 8086 microprocessor	K3	3
CO4	Describe the basic concept of 8051 microcontroller architecture	K2	4
CO5	Demonstrate the various interfacing of 8051 microcontroller.	K3	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3			2			2	2	3	3		3		2
CO2		2	3		2		2	2	3	3		3		2
CO3		2	3	2			2	2	3	3		3		
CO4	3		3	3			2	2	3	3		3		
CO5		2	3	3	2		2	2	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**THE 8086 MICROPROCESSOR**	**9**
Introduction to 8086 – Microprocessor Architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming – Modular programming – Linking and routines – Byte Relocation – Stacks – Procedures – Macros - Interrupts and Interrupt service and String manipulation		
Topic - 2	**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.		
Topic - 3	**I/O INTERFACING**	9
Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller. 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		
Topic - 4	**MICROCONTROLLER**	**9**
Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.		
Topic - 5	**INTERFACING MICROCONTROLLER**	**9**
Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, and Introduction to PIC and ARM processors.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Marilyn Wolf, "Computers as Components – Principles of Embedded Computing System Design", Third Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
2	K.V.Shibu, "Introduction to Embedded Systems", McGraw Hill,2nd Edition, 2017
3	Prasad.K.V.K.K, Embedded Real-Time Systems: Concepts, Design & Programming, Dreamtech

OTHER REFERENCES	
1	**https://youtu.be/1m-jgtGetl4**
2	**https://youtu.be/QP-4FlwNTvw**
3	**https://youtu.be/5fESTph5gA8**

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E. ECE	20EC4T5	ELECTRONICS CIRCUITS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyse and design bipolar and FET amplifier circuits to meet certain specifications.	K4	1
CO2	Analyse the frequency response of amplifier circuits, taking into account various circuit capacitors, to determine the bandwidth of the circuit.	K3	2
CO3	Understand the characteristics of the various types of feedback configurations to be able to determine the type of feedback circuit required for a specific design application and to design stable feedback amplifiers.	K2	3
CO4	Understand the principle of sine-wave oscillators, and to analyse and design various audio & radio frequency oscillator circuits.	K2	4
CO5	Understand the analysis and design of tuned amplifier to meet certain neutralization techniques.	K2	5

PRE-REQUISITE	Electronic Devices

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1						1	1		1	2	
CO2	3	2	1						2	1		1	2	1
CO3	3	1							1	1		1	2	
CO4	3	2		1					2	1		1	2	
CO5	3	2		1					2	1		1	2	1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**BJT AMPLIFIERS**	**9**
Overview of DC analysis of BJT circuits and models, AC load line analysis, AC analysis of basic BJT amplifier configurations using classical discrete circuit bias arrangements: Common-Emitter, Common-Base, Common-Collector and single-tuned circuits.Multi-stage amplifier configurations: CE - CE, CE - CC, CE - CB, and CC - CC amplifiers, Frequency response analysis of a basic BJT CE amplifier.		
Topic - 2	**FET AMPLIFIERS**	**9**
Introduction Graphical analysis, load lines, and small-signal models, AC analysis of basic MOSFET amplifier configurations using classical discrete circuit bias arrangements: Common-Source, Common-Drain and Common-Gate circuits, Frequency response analysis of FET CS amplifier		
Topic - 3	**FEEDBACK AMPLIFIERS**	**9**
General Feedback Structure – Properties of negative feedback – Basic Feedback Topologies – Feedback amplifiers – Series – Shunt, Series – Series, Shunt – Shunt and Shunt – Series Feedback – Determining the Loop Gain – Stability Problem – Nyquist Plot – Effect of feedback on amplifier poles – Frequency Compensation		
Topic - 4	**OSCILLATORS**	**9**
Classification, Barkhausen Criterion - Mechanism for start of oscillation and stabilization of amplitude, General form of an Oscillator, Analysis of LC oscillators - Hartley, Colpitts,Clapp, RC oscillators - phase shift –Wienbridge - Twin-T Oscillators, Frequency range of RC and LC Oscillators, Quartz Crystal Construction, Electrical equivalent circuit of Crystal, Miller and Pierce Crystal oscillators, frequency stability of oscillators.		
Topic - 5	**TUNED AMPLIFIERS**	**9**
Coil losses, unloaded and loaded Q of tank circuits, 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 – large signal tuned amplifiers – Class C tuned amplifier – Efficiency and applications of Class C tuned amplifier - Stability of tuned amplifiers – Neutralization - Hazeltine neutralization method.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	David A. Bell, “Electronic Devices and Circuits”, 5th edition, Oxford University Press, 2015.
2	Donald Neamen, “Electronic Circuits: Analysis and Design”, 3rd edition, McGraw-Hill Education, 2011.
4	Muhammad Rashid, “Microelectronic Circuits: Analysis & Design”, 2nd edition, Cengage Learning, 2010

OTHER REFERENCES	
1	https://youtube.com/playlist?list=PLwjK_iyK4LLDoFG8F
2	https://youtu.be/T-0X1N9N5V8
3	https://youtu.be/fy0sXbrkMew
4	https://youtu.be/mn1Qg0ALYds
5	https://youtu.be/mn1Qg0ALYds

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E. ECE	20EC4T6	ELECTROMAGNETIC FIELDS	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the concepts of Electromagnetic model and Coordinate systems	K2	1
CO2	Apply the concepts of Electric Potential, Boundary conditions, capacitance and laws related to Electric fields.	K3	2
CO3	Apply the concepts of Magnetic Potential, Boundary conditions, Inductance and laws related to Magnetic fields.	K3	3
CO4	Analyse the concepts of Maxwell's equations, Electromagnetic boundary conditions, & Wave equations in Time Varying fields	K4	4
CO5	Evaluate the concepts of Plane waves in lossless media and lossy media.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2			1	3	3		3		
CO2	3	2	3	2	2			1	3	3		3		
CO3	3	2	3	2	2			1	3	3		3		
CO4	3	3	3	2	2			1	3	3		3		
CO5	3	2	3	2	2			1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9 + 3**
Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem		
Topic - 2	**ELECTROSTATICS**	**9 + 3**
Electric field, Coulomb's law, Gauss's law and applications, Electric potential, Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Capacitance, Parallel, cylindrical and spherical capacitors, Electrostatic energy, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law, Electromotive force and Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law		
Topic - 3	**MAGNETOSTATICS**	**9 + 3**
Lorentz force equation, Law of no magnetic monopoles, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy, Magnetic forces and torques		
Topic - 4	**TIME-VARYING FIELDS AND MAXWELL's EQUATIONS**	**9 + 3**
Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields.		
Topic - 5	**PLANE ELECTROMAGNETIC WAVES**	**9 + 3**
waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	D.J. Griffiths, Introduction to electrodynamics, 4th ed., Pearson (India), 2015
2	B.M. Notaros, Electromagnetics, Pearson: New Jersey, 2011.
3	M.N.O. Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th ed., Oxford (Asian Edition), 2015.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=pGdr9WLto4A&list=PL1CE5B4FFFA997E5D
2	https://www.youtube.com/watch?v=FtEShPAFpek&list=PL_mruqjnuVd87sjSDVS9wuit9CSpgIIfx
3	https://www.youtube.com/watch?v=UWQuMnWcmwc
4	https://www.youtube.com/watch?v=W1cTpqM9DaU
5	https://www.youtube.com/watch?v=8kcvyoHsXrw

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E. ECE	20EC4L1	LINEAR INTEGRATED CIRCUITS LABORATORY	0	0	2	1

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	Acquire knowledge on Application of Op-Amp.	K3
CO2	Design filters using op-amp and performs an experiment on Instrumentation amplifier.	K3
CO3	Analyze the working of schmitt trigger and oscillator using Op-amp.	K4
CO4	Design DC power supply using specified ICs. -	K4
CO5	Analyze the performance of Astable and Monostable multivibrators using Op- amp and NE555 Timer.	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	**2**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**
CO2	**3**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**2**
CO3	**3**	**-**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**
CO4	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**1**
CO5	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Inverting, Non inverting and differential amplifiers.
2	Integrator and Differentiator.
3	Instrumentation amplifier.
4	Active low-pass, High-pass and band-pass filters.
5	Astable & Monostable multivibrators using Op-amp.
6	Schmitt Trigger using op-amp.
7	Phase shift and Wien bridge oscillators using Op-amp.
8	Astable and Monostable multivibrators using NE555 Timer.
9	DC power supply using LM317 and LM723.
10	Study of SMPS.
11	Active low-pass, High-pass and band-pass filters using Op-amp simulate using PSPICE.
12	Astable and Monostable multivibrators using NE555 Timer simulate using PSPICE.
13	Analog multiplier simulate using PSPICE.

THEORY	0		TUTORIAL	0		PRACTICAL	30		TOTAL	30

BOOK REFERENCES	
1	Linear Integrated CircuitsLaboratory Manual, Al-Ameen Publications, 2020.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=csZzm71C0xI
2	https://www.youtube.com/watch?v=oeiho7-CeZA
3	https://www.youtube.com/watch?v=gfq1rmIog-g
4	https://www.youtube.com/watch?v=Q6MaHSxi3bA
5	https://www.youtube.com/watch?v=gEeF8sEQTEc

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E – ECE	20EC4L2	MICROPROCESSOR AND MICROCONTROLLER LABORATORY	0	0	2	1

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Microprocessor And Microcontroller Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication. -	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	3	3	-	-	-	-
CO2	3	-	-	-	3	-	-	2	3	-	1	-	-	-
CO3	3	2	-	2	-	1	-	-	-	3	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	3	-	1	-	-

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
	8086 Programs using kits
1	Basic arithmetic and Logical operations
2	Move a data block without overlap
3	Code conversion, decimal arithmetic and Matrix operations
4	Floating point operations, string manipulations, sorting and searching
5	Password checking, Print RAM size and system date
6	Counters and Time Delay.
	Peripherals and Interfacing Experiments
7	Traffic light controller
8	Stepper motor control
9	Digital clock
10	Key board and Display
11	Serial interface and Parallel interface
12	A/D and D/A interface and Waveform Generation Traffic light controller
	8051 Experiments using kits and MASM
13	Basic arithmetic and Logical operations
14	Square and Cube program, Find 2„s complement of a number

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**30**		**TOTAL**	**30**

BOOK REFERENCES	
1	Microprocessor And Microcontroller Laboratory , Al-Ameen Publications, 2020.

OTHER REFERENCES	
1	https://youtu.be/t3thKRqMK2M
2	https://youtu.be/TtAsMwhVcAs
3	https://youtu.be/QVBgKAZIvpI
4	https://youtu.be/98gmOUItrPk
5	https://youtu.be/0PLyBaZ6MCU

Semester	Programme	Course Code	Course Name	L	T	P	C
IV	B.E. / B.Tech., Common to all	20HSCT1	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	2	1	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand and aware of themselves, and their surroundings (family, society, nature)	K2	1
CO2	Build more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind	K3	2
CO3	Relate the critical ability and sensitive to their commitment towards what they have understood (human values, human relationship and human society).	K2	3
CO4	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.	K3	4
CO5	Appraise local, regional and a national culture in harmony with others	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3					2					2		
CO2		3					3		2					
CO3								3				2		
CO4		2				2	2							
CO5								3		2		2		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**	**9**
1. Purpose and motivation for the course, recapitulation from Universal Human Values-I 2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.		
Topic - 2	**Understanding Harmony in the Human Being - Harmony in Myself!**	**9**
7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body' 8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility 9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) 10. Understanding the characteristics and activities of 'I' and harmony in 'I' 11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail 12. Programs to ensure Sanyam and Health.		
Topic - 3	**Understanding Harmony in the Family and Society- Harmony in Human Relationship**	**9**
13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship 14. Understanding the meaning of Trust; Difference between intention and competence 15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship 16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals 17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.		
Topic - 4	**Understanding Harmony in the Nature and Existence - Whole existence as Coexistence**	**9**
18. Understanding the harmony in the Nature 19. Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self regulation in nature		

20. Understanding Existence as Co-existence of mutually interacting units in all pervasive space 21. Holistic perception of harmony at all levels of existence.		
Topic - 5	**Implications of the above Holistic Understanding of Harmony on Professional Ethics**	**9**
22. Natural acceptance of human values 23. Definitiveness of Ethical Human Conduct 24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. 26. Case studies of typical holistic technologies, management models and production systems 27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations 28. Sum up		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Jeevan Vidya: E.K. Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004
3	The Story of Stuff (Book)by Annie Leonard , 2011
4	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5	Small is Beautiful - E. F Schumacher.
6	Slow is Beautiful - Cecile Andrews
7	Economy of Permanence - J C Kumarappa
3	India Wins Freedom - Maulana Abdul Kalam Azad
4	Vivekananda - Romain Rolland (English)
4	Gandhi - Romain Rolland (English)

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=XGxNCFjDGEg
2	https://www.c-span.org/video/?292709-1/the-story-stuff

SEMESTER V

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20EC5T1	Digital Signal Processing	PC	50	50	3	1	0	4
2	20EC5T2	Analog and Digital Communication	PC	50	50	3	1	0	4
3	20EC5E1 TO 20EC5E4	Professional Elective–I	PE	50	50	3	0	0	3
4	20EC5E5 TO 20EC5E9	Professional Elective- II	PE	50	50	3	0	0	3
5		Open Elective–I	OE	50	50	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENTS									
6	20EE5LT1	Control Systems Engineering	PC	50	50	2	0	4	4
LABORATORY COURSE									
7	20EC5L1	Digital Signal Processing Laboratory	PC	50	50	0	0	3	1.5
MANDATORY COURSE									
8	20PT5T1	Career Guidance - I	MC	100	--	2	1	0	0
Total						**19**	**3**	**7**	**22.5**

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. ECE	20EC5T1	DIGITAL SIGNAL PROCESSING	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the frequency domain behaviour of a given Discrete Time signal using Discrete Fourier Transform	K2	1
CO2	Construction of Realization structures and design for IIR filters	K3	2
CO3	Construction of Realization structures and design for FIR filters	K3	3
CO4	Analyze the effect of finite word length for fixed &floating point number representation.	K4	4
CO5	Develop an algorithm using TSM320C6X Processor for simple signal processing applications.	K5	5

PRE-REQUISITE	SIGNALS AND SYSTEMS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2					1	3	3		3	2	
CO2	2	3	2		2			1	3	3		3	2	
CO3	2	3	2		2			1	3	3		3	2	
CO4	2	2	2		2			1	3	3		3	2	
CO5	2	1		3				1	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**DISCRETE AND FAST FOURIER TRANSFORM**	**9+3**
Introduction to DFT – Efficient computation of DFT – Properties of DFT – FFT Algorithms – Decimation in Time (DIT) and Decimation in Frequency (DIF) Algorithms – Linear and Circular Convolution.		
Topic - 2	**IIR FILTER DESIGN**	**9+3**
Analog filter design – Discrete time IIR filter from analog filter – IIR filter design: Impulse Invariance, Bilinear transformation technique – Realization using Direct form I, Direct form II and Cascade forms.		
Topic - 3	**FIR FILTER DESIGN**	**9+3**
Linear phase FIR filters – Filter design: windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency Sampling method.		
Topic - 4	**FINITE WORD LENGTH EFFECTS**	**9+3**
Fixed point and floating point number representations – Quantization – Truncation and Rounding errors – Quantization noise – coefficient quantization error – Product quantization error – Overflow error – Round-off noise power – limit cycle oscillations due to product round-off and Overflow errors – Principle of scaling..		
Topic - 5	**MULTIRATE SIGNAL PROCESSING AND DSP APPLICATIONS**	**9+3**
Introduction to Multirate signal processing – Decimation – Interpolation – Sampling rate conversion by a rational factor – Adaptive Filters: Introduction – Applications of adaptive filtering to equalization- Introduction to DSP Processor (TMS320C50).		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	John G. Proakis &Dimitris G. Manolakis, “Digital Signal Processing – Principles, Algorithms & Applications”, Pearson Education / Prentice Hall, Fourth Edition, 2007.
2	Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”, McGraw Hill, 4th edition 2013.
3	A.V.Oppenheim, R.W. Schafer and J.R. Buck, “Discrete-Time Signal Processing”, Pearson, 8th Indian Reprint, 2004.

OTHER REFERENCES	
1	http://www.nptelvideos.in/2012/12/digital-signal-processing.html, “Digital Signal Processing”, Prof. S.C Dutta Roy, IIT Delhi.
2	http://www.nptelvideos.in/2012/11/digital-signal-processing.html, “Digital Signal Processing”, Prof.T.K.Basu, IIT Kharagpur.
3	https://www.youtube.com/watch?v=W1cTpqM9DaU
4	https://www.youtube.com/watch?v=FtEShPAFpek&list=PL_mruqjnuVd87sjSDVS9wuit9CSpgIIfx
5	https://www.youtube.com/watch?v=8kcvyoHsXrw

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. ECE	20EC5T2	ANALOG AND DIGITAL COMMUNICATION	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Apply the concept of amplitude modulation and infer the effect of noise in AM receivers	K3	1
CO2	Make use of the concept of narrowband and wide band FM and interpret the effect of noise in FM receivers	K3	2
CO3	Identify the notion of baseband pulse transmission, inter-symbol interference and its compensation methods	K3	3
CO4	Apply the scheme of pass band digital transmission for band limited and wideband signals	K3	4
CO5	Inspect the characteristics of discrete memory less channel and provide the solution for lossless, error free communication	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1				1	3	3		3	3	1
CO2	3	2	1	1				1	3	3		3	2	1
CO3	3	2	1	1				1	3	3		3	3	1
CO4	3	2	1	1	1			1	3	3		3	2	1
CO5	3	3	2	2	1			1	3	3		3	2	1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**AMPLITUDE MODULATION**	**9 +3**
Introduction: Modulation and its need– Linear modulation schemes: DSBSC, SSBSC and VSB-power spectrum –Frequency translation – Frequency division multiplexing – Superheterodyne receivers – Noise in AM receivers:coherent detection, envelope detection		
Topic - 2	**ANGLE MODULATION**	**9 +3**
Frequency modulation, Narrowband FM, Wideband FM – Generation of FM: indirect method – FM demodulation:frequency discriminator – Non-linear effects in FM systems – Noise in FM receivers – capture effect – pre-emphasisand de-emphasis in FM		
Topic - 3	**PULSE MODULATION AND BASEBAND PULSE TRANSMISSION**	**9 +3**
Sampling process – PAM – Quantization process –PCM – TDM – Delta modulation, Line coding: unipolar NRZ,Polar NRZ, Unipolar RZ, Manchester – Matched Filter as optimum receiver – Intersymbol Interference – Eyepatterns – Nyquist Criterion for distortion less baseband binary transmission – Pulse shaping with raised cosine filter– Duobinary signaling – Adaptive equalization : LMS algorithm		
Topic - 4	**PASSBAND DIGITAL TRANSMISSION AND SPREAD SPECTRUM COMMUNICATION**	**9 +3**
Introduction – Coherent Phase shift keying: BPSK, QPSK, OQPSK, π/4 shifted QPSK – QAM- BER analysis ofBPSK and QPSK-concepts of MSK-Spread Spectrum: PN sequence and its properties-Direct Sequence SpreadSpectrum-Frequency Hopping Spread Spectrum		
Topic - 5	**INFORMATION THEORY AND CODING**	**9 +3**
Entropy and its properties – Source coding theorem : Huffman coding, LZ coding – Discrete Memory less Channel –mutual information and its properties – Channel coding theorem – information capacity theorem; Hamming codes –Convolutional codes – Trellis diagram– Viterbi algorithm – Trellis coded modulation :8 array PSK		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	B. Sklar, ―Digital Communication Fundamentals and Applications‖, 2nd Edition, Pearson Education, 2009
2	B.P.Lathi, ―Modern Digital and Analog Communication Systems‖ 3rd Edition, Oxford UniversityPress 2007.
3	H P Hsu, Schaum Outline Series - ―Analog and Digital Communications‖, TMH 2006

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=dZAg5YLyJqw
2	https://www.youtube.com/watch?v=qQcpnmJNluU
3	https://www.youtube.com/watch?v=bm0f8mBBsjc
4	https://www.youtube.com/watch?v=KXFF8m4uGDc
5	https://www.youtube.com/watch?v=M75X-QzY834

Semester	Programme	Course Code	Course Name	L	T	P	C
V	Common to B.E. EEE & ECE	20EE5LT1	CONTROL SYSTEMS ENGINEERING	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Develop various representations of system based on the knowledge of Mathematics, Science and Engineering fundamentals.	K3	1
CO2	Conclude time domain analysis of various models in linear system and analyzing various controllers in closed loop system.	K4	2
CO3	Conclude frequency domain analysis of various models in linear system.	K5	3
CO4	Examine the stability of a given system using various methods.	K4	4
CO5	Design a lag, lead and lag lead compensator and examine a system using state variables.	K6	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2							1	3	3		3		
CO2	3	2	2					1	3	3		3		2
CO3	2	2	3	2				1	3	3		3		
CO4	3	2	2	3	2			1	3	3		3	2	
CO5	3	3	3	3	3			1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments & Model Practical
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**SYSTEMS AND ITS REPRESENTATION**	**6**
Basic elements in control systems – Open and closed loop system – Electrical analogy of mechanical system – Transfer function of mechanical and electrical system –Block diagram reduction technique– Signal flow graph.		
Topic - 2	**TIME DOMAIN ANALYSIS**	**6**
Time response of first order and second order systems for unit step test signals–Time domain specifications– Steady state response – Root locus technique - Effects ofP,D, PI systems.		
Topic - 3	**FREQUENCY DOMAIN ANALYSIS**	**6**
Frequency response- Frequency domain specifications - Correlation between frequency domain and time domain specifications - Bode plot, Polar plot.		
Topic - 4	**STABILITY ANALYSIS**	**6**
Concepts of stability - Necessary conditions for Stability - Characteristics equation - Location of roots in S plane for stability - Routh Hurwitz criterion-Nyquist stability criterion.		
Topic - 5	**COMPENSATORS AND STATE VARIABLES**	**6**
Compensator - Deign of Lag compensator - Lead compensator - Lag-lead compensator using Bode plot - Concept of state variables, state model, Controllability and observability.		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

LIST OF EXPERIMENTS	
1	P, PI and PID controllers
2	Stability Analysis
3	Modeling of Systems – Machines, Sensors and Transducers
4	Design of Lag, Lead and Lag-Lead Compensators
5	Position Control Systems
6	Synchro-Transmitter- Receiver and Characteristics
7	Bridge Networks –AC and DC Bridges
8	Dynamics of Sensors/Transducers a. Temperature b. Displacement

	c. Optical d. Strain e. Flow
9	Power and Energy Measurement
10	Signal Conditioning a. Instrumentation Amplifier b. Analog – Digital and Digital –Analog converters (ADC and DACs)
11	Design and implementation of First order systems.
12	Design and implementation of Second order systems.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	Nagarath, I.J. and Gopal, M., "Control Systems Engineering", New Age InternationalPublishers, 2017
2	Benjamin C. Kuo, "Automatic Control Systems", Wiley, 2014.
3	Katsuhiko Ogata, "Modern Control Engineering", Pearson, 2015.
4	Richard C.Dorf and Bishop, R.H., "Modern Control Systems", Pearson Education,2009.
5	Control and Instrumentation Manual, Al-Ameen Publications, 2020.

OTHER REFERENCES	
1	John J.D., Azzo Constantine, H. and Houpis Sttuart, N Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor& Francis Reprint 2009.
2	M.Gopal, "Control System: Principle and design", McGraw Hill Education, 2012.
3	https://youtu.be/V09Ct3RYSWU
4	https://youtu.be/65GGqUZNi4s
5	https://youtu.be/NQAQkSyOnBY

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. ECE	20EC5L1	DIGITAL SIGNAL PROCESSING LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		**RBT Level**
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the Digital Signal Processing Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication -	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	3	-	-	-	2	2	-	2	-	2
CO2	3	-	3	-	3	-	-	-	2	2	-	2	-	2
CO3	3	2	2	-	3	-	-	-	3	2	2	2	2	2
CO4	3	-	2	-	3	-	-	-	3	2	2	3	2	3
CO5	3	2	2	-	3	-	-	-	3	2	-	2	-	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Introduction to Matlab for Signal Processing
2	Sampling of Continuous time Signals
3	Linear and Circular Convolution
4	Computation of DFT of a signal using FFT algorithms
5	Design and Simulation of IIR and FIR filters
6	Design and Simulation of IIR and FIR filters using DSP Kit
7	Linear Convolution using DSP Kit
8	Generation of Signals using DSP Kit
9	Convolution Operation using DSP Kit
10	Implementation of FFT algorithms using DSP Kit

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	Digital Signal Processing Laboratory Manual, Al-AmeenPublications,2020

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=pGdr9WLto4A&list=PL1CE5B4FFFA997E5D
2	https://www.youtube.com/watch?v=FtEShPAFpek&list=PL_mruqjnuVd87sjSDVS9wuit9CSpgIIfx
3	https://www.youtube.com/watch?v=UWQuMnWcmwc
4	https://www.youtube.com/watch?v=W1cTpqM9DaU
5	https://www.youtube.com/watch?v=8kcvyoHsXrw

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. / B. Tech. (CSE, EEE, ECE & IT)	20PT5T1	Career Guidance - I	2	1	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the basic concepts of logical reasoning Skills	K1	1
CO2	Understand the basic concepts of Quantitative Aptitude.	K2	2
CO3	Understand the importance and type of communication in personal and professional environment.	K3	3
CO4	To provide insight into much needed technical and non technical qualities in career planning.	K4	4

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3			3	3		3		
CO2						2			3	3		2		
CO3						3			3	2		1		
CO4						2			3	3		2		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Quiz
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**LOGICAL REASONING**	**5**
LR 1: Series, Odd man out, Analogy LR 2: Coding and Decoding LR 3: Direction, Ranking and Ordering LR 4: Blood Relation LR 5: Venn Diagram, Decision Making LR 6: Syllogism		
Topic - 2	**QUANTITATIVE APTITUDE**	**12**
NR 1: Average NR 2: Percentage NR 3: Profit and Loss NR 4: Ages NR 5: Ratio and Proportion NR 6: Allegation and Mixture NR 7: Time and Work NR 8: Time, Speed and Distance NR 9: Trains, Boats and Streams		
Topic - 3	**VERBAL REASONING & BUSINESSES COMMUNICATION**	**3**
VR 1:Preposition & Conjunction VR 2: Synonyms, Antonyms & Tenses BS1: Art of Introduction, Communication Barriers, Personal Interview.		
Topic - 4	**TECHNICAL CODING**	**10**
TECH 1: I/O, Operaters TECH 2: Conditional statement (branching and jumping statement) TECH 3: Control statements and patterns programming TECH 4: 1D and pointers.		

THEORY	**20**		**TUTORIAL**	**10**		**PRACTICAL**	**0**		**TOTAL**	**30**

BOOK REFERENCES	
1	Logical Reasoning and Data Interpretation for CAT by Nishit K. Sinha
2	Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha
3	A Modern Approach To Verbal Reasoning by R S Aggarwal.
4	Computer Programming for Beginners: Fundamentals of Programming Terms and Concepts - Nathan Clark

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=x0WkptLF6oE&list=PLpyc33gOcbVADMKqylI__O_O_RMeHTyNK
2	https://www.youtube.com/watch?v=LMY7GoAMcDI
3	https://www.youtube.com/watch?v=K7sj1yzXzng
4	https://www.youtube.com/watch?v=fyzmCU931QE
5	https://www.youtube.com/c/TechnicalCoding

SEMESTER VI

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20EC6T1	Antenna and wave Propagation	PC	50	50	3	1	0	4
2	20EC6T2	VLSI Design	PC	50	50	3	1	0	4
3		Professional Elective–III	PE	50	50	3	0	0	3
4		Professional Elective- IV	PE	50	50	3	0	0	3
5		Open Elective–II	OE	50	50	3	0	0	3
THEORY COURSES WITH LABORATORY COMPONENTS									
6	20CSCLT1	Data Communication and Networks	PC	50	50	2	0	4	4
LABORATORY COURSE									
7	20EC6L1	VLSI Design Laboratory	PC	50	50	0	0	3	1.5
8	20EC6L2	Mini Project	EEC	100	--	0	0	4	2
MANDATORY COURSE									
9	20PT6T1	Career Guidance - II	MC	100	--	2	1	0	0
Total						**19**	**3**	**11**	**24.5**

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. ECE	20EC6T1	ANTENNAS AND WAVE PROPAGATION	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the Hertzian and Half wave dipole antenna using Maxwell‟s equation to determine the electric and magnetic field components.	K4	1
CO2	Determine the radiation pattern, half power beam width and directivity of broadside array and endfire array using pattern multiplication method.	K5	2
CO3	Design the length and width of pyramidal horn antenna with optimum gain at a frequency of C band.	K6	3
CO4	Demonstrate the antenna parameters of gain, radiation pattern, polarization and VSWR using anechoic chamber.	K2	4
CO5	Explain the performance characteristics of various special antennas	K2	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2				1	3	3		3	2	
CO2	3		3					1	3	3		3	2	
CO3	3	3	3	3				1	3	3		3		2
CO4	3	3	2					1	3	3		3		2
CO5	2	2		2				1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**FUNDAMENTALS OF RADIATION**	**9 +3**
Definition of antenna parameters: Radiation pattern, Beam solid angle, Radiation Intensity, Gain, Directivity, Antenna aperture, Radiation Resistance, Input Impedance. Matching- Baluns – Polarization mismatch – Antenna noise temperature – Radiation from Hertizian dipole – Half wave dipole and Folded dipole.		
Topic - 2	**ANTENNA ARRAYS**	**9 +3**
Uniform Linear Array: N element linear array, Broadside and End fire array. Pattern multiplication – Phased array – Adaptive array – Binomial array.		
Topic - 3	**APERTURE ANTENNAS**	**9 +3**
Slot antennas – Horn antenna – Reflector Antenna: Flat reflector, Corner Reflector, Paraboloidal reflector: Feeding structures, Aperture blockage. Microstrip antennas – Numerical tool for antenna analysis.		
Topic - 4	**SPECIAL ANTENNAS AND ANTENNA MEASUREMENT**	**9 +3**
Yagi-Uda Antenna , Log periodic antenna , Helical antenna Antenna Measurements: Radiation pattern, Gain, Polarization, VSWR, Anechoic Chamber.		
Topic - 5	**PROPAGATION OF RADIO WAVES**	**9 +3**
Modes of propagation: Ground wave propagation, Attenuation characteristics – Tropospheric propagation: Duct propagation, Troposcatter propagation – Sky wave propagation: Structure of the ionosphere, Virtual height, critical frequency, Maximum usable frequency, Skip distance, Fading, Multi hop propagation.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas and Wave Propagation", Mc GrawHill Education Private Limited, Fourth Edition, 2015.
2	Constantine.A.Balanis, "Antenna Theory Analysis and Design", Wiley Student Edition, Third Edition, Reprint 2016.
3	K.D.Prasad, "Antennas and wave propagation", Sathya Praksham, 3rd Edition, 2013.
4	R.E.Collin, "Antennas and Radiowave Propagation", Mc Graw Hill, 1985.
5	Edward C.Jordan and Keith G.Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2006

OTHER REFERENCES	
1	https://nptel.ac.in/content/storage2/courses/108101092/
2	https://nptel.ac.in/courses/108/101/108101092/
3	https://www.youtube.com/watch?v=COe7dxkWsCI
4	https://www.youtube.com/watch?v=8_GbiRk_gLI
5	https://www.youtube.com/watch?v=QX0-d54oB7I

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	BE - ECE	20EC6T2	VLSI DESIGN	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Develop digital logic circuits and VLSI systems using Verilog Hardware Description Language Programming	K3	1
CO2	Illustrate the components in the logic synthesis-based design flow	K3	2
CO3	Elaborate the characteristics of MOS transistor and techniques used for VLSI fabrication	K2	3
CO4	Make use of layout design rules to draw layout of logic functions and to design circuits using various logic styles	K3	4
CO5	Apply various testing techniques/algorithms to test circuits	K3	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2		1			1	3	3		3	1	3
CO2	3	2	2		1			1	3	3		3	1	3
CO3	3				1			1	3	3		3		2
CO4	3	2	2		1			1	3	3		3	1	3
CO5	3	2						1	3	3		3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**Verilog HDL**	**9 +3**
Data flow Modelling- Behavioural modelling – Structured Procedures- Blocking and non blocking statements- delay control- event control, conditional statements- multiway branching-loops- Switch level modelling - Tasks and Function		
Topic - 2	**Logic Synthesis and RTL Design**	**9 +3**
Logic Synthesis- Impact of Logic Synthesis- Verilog HDL Synthesis- Synthesis Design Flow- Modelling Tips for Logic Synthesis- RTL Design- 4-bit full adder subtractor- ALU Design – Booth Multiplication- GCD Computation.		
Topic - 3	**MOS Transistor**	**9 +3**
CMOS Logic- MOS Transistor Theory- Long Channel I-V characteristics- C-V characteristics- Nonideal I-V effects DC characteristics-- Power dissipation – Switching Characteristics		
Topic - 4	**MOS Fabrication**	**9 +3**
An overview of silicon semiconductor technology - Basic CMOS technology: N well- P well, Twin tub and SOI Process- Latch up and prevention- Layout Design rules- Stick diagram- Layout diagram for basic logic gates Introduction to Static CMOS- Pseudo nMOS logic -Dynamic CMOS-Cascade Voltage Switch Logic.		
Topic - 5	**CMOS Testing**	**9+3**
Introduction to testing- Logic Verification Principles- Test Vectors-Manufacturing test principles- - Fault Models observability, controllability –Fault coverage- DFT-Ad-Hoc Testing- Scan Design- BIST- D-Algorithm and Boolean Difference Method		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Neil Weste & David Harris , "CMOS VLSI Design-A circuits & System Perspective", 4th Edition, Pearson education, New Delhi, 2017.
2	Palnitkar Samir, "Verilog HDL: Guide to Digital Design and synthesis", 2nd Edition, Pearson Education, New Delhi, 2017.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=PJGvZSlsLKs
2	https://www.youtube.com/watch?v=sIDe76QFG2g
3	https://www.youtube.com/watch?v=6OZLl689pi0
4	https://www.youtube.com/watch?v=sV2xT-WCSSI
5	https://www.youtube.com/watch?v=YpbtAwmYCcI

Semester	Programme	Course Code	Course Name	L	T	P	C
V & VI	B.Tech., IT (V) & B.E. ECE (VI)	20CSCLT1	DATA COMMUNICATION AND NETWORS	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Interpret the importance of layering, addressing and annotate the protocol stack of OSI and TCP/IP model.	K5	1
CO2	Design and analyze error and flow control algorithms for communication between adjacent nodes in a network.	K6	2
CO3	Identify and apply the suitable routing algorithms for the given network.	K3	3
CO4	Simulate the network topologies using NS2 for data communication.	K2	4
CO5	Implement protocols to understand and describe the devices and services used to support communications in data networks and the Internet	K3	5

PRE-REQUISITE	COMPUTER NETWORKS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3					1	3	3	2	3	2	
CO2	1	2	3	2	2			1	3	3		3		2
CO3	3	2	2					1	3	3	2	3		2
CO4	1	3	2	2				1	3	3		3	2	
CO5	3	2						1	3	3	3	3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment & Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**DATA COMMUNICATIONS**	**6**
Introduction: Data Communications, Networks, Network Types, Protocol Layering, TCP/IP Protocol Suite, OSI Model - Physical Layer: Introduction to Physical Layer, Multiplexing and Spectrum Spreading - Transmission Media: Guided Media, Unguided Media.		
Topic - 2	**DATA LINK LAYER**	**6**
Introduction to Data Link Layer: Link Layer Addressing - Error Detection and Correction: Block Coding, Cyclic Codes, Checksum, Forward Error Correction - Data Link Control: DLC services, Data-Link Layer Protocols, HDLC, Point-to-Point Protocol - Media Access Control: Random Access and Controlled Access - Ethernet: IEEE 802.3 - IEEE 802.11.		
Topic - 3	**NETWORK LAYER**	**6**
Network Layer Services - Packet Switching - IPV4 Addresses - Forwarding of IP Packets - Network Layer Protocols: IP, ICMPv4, Mobile IP - Routing Algorithms- Unicast Routing Protocols - Next Generation IP: IPv6 Addressing, IPv6 Protocol.		
Topic - 4	**TRANSPORT LAYER**	**6**
Introduction to Transport Layer: Simple Protocol, Stop-and-Wait Protocol, Go-Back-N Protocol, Selective-Repeat Protocol, Bidirectional Protocols: Piggybacking - User Datagram Protocol - Transmission Control Protocol - Congestion Control.		
Topic - 5	**APPLICATION LAYER**	**6**
Client Server Programming - WWW - HTTP - FTP - Electronic Mail - Telnet - SSH - DNS - SNMP - DHCP - MQTT - IMAP - TLS/SSL		

THEORY	**30**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**30**

LIST OF EXPERIMENTS	
1	Experiment on configuring network topology using packet tracer.
2	Experiment on packet capturing and analyzing using packet tracer.
3	Experiment on error correction code like CRC and Checksum.
4	Experiment on ARP and RARP in live network using Wireshark.
5	Experiment on chat programming using TCP and UDP sockets.
6	Experiment on routing algorithms like Distance Vector and Link State Routing.
7	Implementation of Various Topologies using NS2 Simulator.

8	Program to simulate Stop & Wait protocol.
9	Implementation of Sliding Window Protocol..
10	Program to simulate Distance Vector Routing algorithm.
11	Experiment on Routing algorithms Link state Routing.
12	Experiment on RARP I live network using wireshack.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	Behrouz A. Forouzan, Data Communication and Networking, Fifth Edition, McGraw Hill Education (India) Private Limited, 2013
2	Andrew S Tanenbaum and David J Wetherall, Computer Networks, Fifth Edition, Pearson Education, 2011.
3	William Stallings, Data and Computer Communications, Tenth Edition, Prentice Hall, 2013.
4	Larry L Peterson and Bruce S Davie, Computer Networks: A Systems Approach, Fifth Edition, Elsevier, 2011.
5	James F Kurose and Keith W Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Sixth Edition, Addison-Wesley, 2013

OTHER REFERENCES	
1	http://www.nptel.ac.in/downloads/106105080, "Computer Networks", Prof.Sujoy Ghosh, IIT Kharagpur.
2	https://www.elsevier.com/journals/subjects/computer-science

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	BE ECE	20EC6L1	VLSI DESIGN LABORATORY	0	0	3	1.5

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	State the aim and develop the procedure to conduct the experiment / exercise in the VLSI Design Laboratory Course	K3
CO2	Demonstrate skills at the level of precision (reliably, quickly, smoothly, and accurately with negligible guidance) in performing the experiment / exercise	K3
CO3	Draw inferences from the experiment / exercise conducted and present it professionally	K4
CO4	Demonstrate professionally the results obtained through the experiment / exercise and present conclusions	K4
CO5	Demonstrate an understanding of the concepts, procedures, and applications through verbal and written communication -	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	3	3	-	-	-	-
CO2	3	-	-	-	3	-	-	2	3	-	1	-	-	-
CO3	3	2	-	2	-	1	-	-	-	3	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	3	-	-	-	-	-	-	-	-	3	-	1	-	-

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Design of 16x1 multiplexer using structural modelling.
2	Design of 8 bit carry look ahead adder and BCD adder
3	Modelling of Sequential Digital Systems
4	Modelling of State Machine Design
5	Modelling of Memory Design
6	Design of 4 * 4 array multiplier using structural modelling
7	Design and implementation of 4-bit Adder-Subtractor Unit
8	Design and implementation of ALU
9	Design and implementation of Booth multiplier
10	Design and implementation of Real Time Clock
11	Design of Full adder using CMOS transistor
12	Design of D-Flip flop using CMOS transistor

THEORY	0		TUTORIAL	0		PRACTICAL	45		TOTAL	45

BOOK REFERENCES	
1	VLSI Design Laboratory Manual, Al-Ameen Publications, 2020.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=cghlCRN-tC8
2	https://www.youtube.com/watch?v=6Z1WikEWxH0

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. / B. Tech. (CSE, EEE, ECE & IT)	20PT6T1	Career Guidance - II	2	1	0	0

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the Problems logically and approach the problems in a different manner	K3	1
CO2	Solve the problems easily by using Short-cut method with time management which will be helpful to them to clear the competitive exams for better job opportunity.	K5	2
CO3	Effectively communicate through verbal/oral communication and improve the listening skills	K3	3
CO4	Develop skills in ideation, innovation in algorithmic thinking, and be able to apply them in problem solving	K4	4

PRE-REQUISITE	SOFTSKILL COURSE - I

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3			3	3		3		
CO2						2			3	3		2		
CO3			2			3			3	2		1		
CO4		3	3			2			3	3		2		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Quiz
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**LOGICAL REASONING**	**5**
LR 1: Seating Arrangement LR 2: Critical Reasoning LR 3: Coded Inequality and Condition Grouping LR 4: Cubes and Verbal Reasoning LR 5: Clocks and Calendars		
Topic - 2	**QUANTITATIVE APTITUDE**	**12**
NR 1: Simple Interest and Compound Interest NR 2: Logarithms NR 3: Permutation NR 4: Combination NR 5: Probability NR 6: Number System NR 7: HCF and LCM		
Topic - 3	**VERBAL REASONING & BUSINESSES COMMUNICATION**	**3**
VR 1: Voices & Speech, Parajumbles, Error Spotting VR 2: Reading Comprehension BS1: Effective Communication, Personal Etiquettes,Group Discussion, Resume Writing.		
Topic - 4	**TECHNICAL CODING**	**10**
TECH 1: 2D array TECH 2: String functions and functions TECH 3: structure and union, DS intro TECH 4 : Array list, linked list and it's implementation		

THEORY	**20**		**TUTORIAL**	**10**		**PRACTICAL**	**0**		**TOTAL**	**30**

BOOK REFERENCES	
1	Logical Reasoning and Data Interpretation for CAT by Nishit K. Sinha
2	Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha
3	A Modern Approach To Verbal Reasoning by R S Aggarwal.
4	Computer Programming for Beginners: Fundamentals of Programming Terms and Concepts - Nathan Clark

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=4WCq6leqnHs
2	https://www.youtube.com/watch?v=tnc9ojITRg4&list=PLpyc33gOcbVA4qXMoQ5vmhefTruk5t9lt
3	https://www.youtube.com/watch?v=tWN_-ieZVZU
4	https://www.youtube.com/watch?v=HAnw168huqA
5	https://www.youtube.com/watch?v=HIj8wU_rGIU

SEMESTER VII

Sl. No.	Course Code	Course Title	Category	CIA	ESE	L	T	P	C
THEORY COURSES									
1	20HSCT2	Professional Ethics	HS	50	50	3	0	0	3
2	20EC7T1	RF and Microwave Engineering	PC	50	50	3	1	0	4
3	20EC7T3	Fiber Optic Communications	PC	50	50	3	1	0	4
4		Open Elective - III	OE	50	50	3	0	0	3
5		Open Elective - IV	OE	50	50	3	0	0	3
THEORY COURSE WITH LABORATORY COMPONENTS									
6	20ECCLT1	Embedded Systems	PC	50	50	2	0	4	4
LABORATORY COURSE									
7	20EC7L1	RF and Microwave Laboratory	PC	50	50	0	0	2	1
8	HX8001	Professional Readiness for Innovation, Employability and Entrepreneurship	EEC	100	--	0	0	6	3
Total						**17**	**2**	**12**	**25**

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E. ECE	20HSCT2	Professional Ethics	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Articulate engineering ethics theory with sustained lifelong learning. actions.	K2	1
CO2	Adopt a good character and follow high professional ethical life.	K2	2
CO3	Contribute to shape a better character by following ethical	K3	3
CO4	Confront and resolve moral issues occurred during technological activities.	K4	4
CO5	Resolve moral and ethical problems through exploration and assessment by established experiments	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2					2	1	3	3	2	2	1	1	
CO2	2					3	1	2	2	1	2	1	1	
CO3	2					1	2	3	3	1	2			1
CO4	1					2	1	3	2	1	2			1
CO5	2					1		2	1		2			

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENTS		
Topic - 1	**HUMAN VALUES**	**9**
Morals and Ethics - Honesty - Integrity - Values - Work Ethic - Civic Virtue - Respect for Others – Living Peacefully - Caring and Sharing - Self-Confidence - Courage - Co-operation - Commitment – Empathy.		
Topic - 2	**ENGINEERING ETHICS AND PROFESSIONALISM**	**9**
Scope of Engineering Ethics- Variety of moral issues - Types of inquiry - Accepting and sharing responsibility - Ethical dilemmas - Moral autonomy - Kohlbergs and Gilligan's theory - Consensus and controversy - Senses of corporate responsibility - Codes of ethics: Importance - justification - limitation - Abuse.		
Topic - 3	**ENGINEERING AS SOCIAL EXPERIMENTATION**	**9**
Engineering as experimentation - Engineers as responsible experimenters - Balanced outlook on law - Cautious optimism - Safety and risk - Assessing and reducing risk - Safe exits - The Challenger case study - Bhopal Gas Tragedy - The Three Mile Island and Chernobyl.		
Topic - 4	**WORKPLACE RESPONSIBILITIES AND RIGHTS**	**9**
Fundamental Rights - Responsibilities and Duties of Indian Citizens - Teamwork - Ethical corporate Climate - Collegiality and loyalty - Managing conflict - Respect for authority - Collective bargaining - Confidentiality - Conflicts of interest - Occupational crime - Professional rights - Employee rights.		
Topic - 5	**GLOBAL ISSUES**	**9**
Multinational corporations: Technology transfer and appropriate technology - International rights - promoting morally just measures - Environmental ethics: Engineering, ecology - economics - Human and sentient centred - and bio and eco centric ethics - Consulting engineers - Engineers as expert witnesses and advisors - Moral leadership		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Mike W Martin and Roland Schinzinger, Ethics in Engineering, 4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 2014.
2	M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi, 2012.

OTHER REFERENCES	
1	R S Naagarazan, A text book on professional ethics and human values, New age international (P)
2	Charles D Fleddermann, Engineering Ethics, Pearson Education/ Prentice Hall of India, New Jersey, 2004.
3	Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics - Concepts and Cases, Wadsworth Thompson Learning, United States, 2005.
4	http://www.slideworld.org/slidestag.aspx/human-values-and- Professional-ethics
5	https://www.youtube.com/watch?v=0ibZPqHcb5Y

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E. ECE	20EC7T1	RF AND MICROWAVE ENGINEERING	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the working and performance of RF and Microwave Passive Devices.	K2	1
CO2	Design and analyze different filter techniques and its characteristics	K3	2
CO3	Analyze the working and performance of Microwave signal generators.	K3	3
CO4	Analyze the working of high frequency semiconductor devices.	K4	4
CO5	Analyze the performance of planar transmission lines.	K5	4

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2						1	3	3		3	2	
CO2	1		3					1	3	3		3	2	
CO3	2		1					1	3	3		3	2	
CO4	1	2	3					1	3	3		3	2	
CO5	1	2	3					1	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**HIGH FREQUENCY NETWORK CHARACTERIZATION AND PASSIVE DEVICES**	**9+3**
Basic Definitions of Networks; Interconnecting Networks; Scattering Parameters: Definition, Chain Scattering Matrix, Conversion of S-parameters, Generalized S-parameters and Practical Measurements; S parameter representation of N port networks, properties -S Matrix of a Directional Coupler- waveguide tees and rat race coupler-Qualitative discussion on: Waveguide Corners- Bends- Twists- Matched loads and movable shorts.		
Topic - 2	**HIGH FREQUENCY CIRCUITS**	**9+3**
RF Passive Components: Resistor, Inductor and Capacitor at High Frequency; Chip Resistor, Chip Capacitor and Surface Mounted Inductors, Microstrip lines-Microstrip Filter Design; Amplifier Design: Characteristics, Power Relations, Stability considerations, Constant Gain, Noise Figure and Constant VSWR circles.		
Topic - 3	**MICROWAVE SIGNAL GENERATOR**	**9+3**
Two cavity Klystron amplifier - Transit time effect- Velocity modulation - current modulation-bunching - Reflex Klystron-Slow-Wave structures - Helix Traveling Wave Tubes- Convection Current- Axial Electric Field- Wave Modes- Bandwidth, Power and Gain Considerations - cross field device-Magnetron – power and frequency considerations.		
Topic - 4	**HIGH FREQUENCY SEMICONDUCTOR DEVICES**	**9+3**
Gunn-Effect -Gunn Diode- Differential Negative Resistance- Modes of Operation-Amplification-Microwave Generation Read Diode- Physical Description- Avalanche Multiplication IMPATT Diodes-TRAPATT Diode- BARITT Diode-Principles of Operation- Physical Structures; RF Bipolar Junction Transistor, RF Field Effect Transistor: Construction, High Electron Mobility Transistor: Functionality, Frequency Response, Temperature Behaviour and Noise Performance.		
Topic - 5	**MICROWAVE MEASUREMENTS**	**9+3**
Slotted line VSWR measurement- impedance measurement- insertion loss and attenuation measurements-measurement of scattering parameters - Return loss measurement using directional coupler-Introduction to vector network analyzer and its uses- return loss and insertion loss-Measurement of return loss and Insertion loss using Spectrum analyzer.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Samuel.Y.Liao, MicrowaveDevices and Circuits, PHI, 2000.
2	David.M.Pozar, Microwave Engineering, John Wiley, 2003
3	Annapurna Das and SisirK.Das,Microwave Engineering, Tata Mc Graw-Hill,2000.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=pGdr9WLto4A&list=PL1CE5B4FFFA997E5D
2	https://www.youtube.com/watch?v=FtEShPAFpek&list=PL_mruqjnuVd87sjSDVS9wuit9CSpgIIfx
3	https://www.youtube.com/watch?v=UWQuMnWcmwc
4	https://www.youtube.com/watch?v=W1cTpqM9DaU
5	https://www.youtube.com/watch?v=8kcvyoHsXrw

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E. ECE	20EC7T3	FIBER OPTIC COMMUNICATIONS	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the behaviour of different optical medium (fibers) and performance of signal Propagation	K4	1
CO2	Analyze the issues in propagation of optical signals resulting from signal degradation mechanism of optical fiber media	K4	2
CO3	Analyze the performance of light sources and apply the concept for choice of light sources for agiven optical link	K4	3
CO4	Apply the concept of working of optical receivers and identify the type of receiver for differentoptical links	K3	4
CO5	Assess the power loss and signal dispersive nature of optical media and apply the result to identifyappropriate transmitter, receiver, on line	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3			2	2	3	3		3	2	1
CO2	3	2	2	3			2	2	3	3		3	1	2
CO3	3	2	2	1			2	2	3	3		3	2	3
CO4	1	3	2	1			2	2	3	3		3	2	2
CO5	3	2	3	1			2	2	3	3		3	1	1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO OPTICAL FIBERS**	**9 +3**
Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations. Mode theory of Circular Waveguides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes Single-Mode Fibers		
Topic - 2	**SIGNAL DEGRADATION OPTICAL FIBERS**	**9 +3**
Attenuation, Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Waveguides-Information Capacity determination. Group Delay-Material Dispersion, Waveguide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling, Design Optimization of SM fibers. RI profile and cut-off wavelength.		
Topic - 3	**FIBER OPTICAL SOURCES AND COUPLING**	**9 +3**
Direct and indirect Band gap materials LED structures Light source materials Quantum efficiency and LED power, Modulation of a LED, lasers Diodes Modes and Threshold condition Rate equations External Quantum efficiency Resonant frequencies		
Topic - 4	**FIBER OPTICAL RECEIVERS**	**9 +3**
PIN and APD diodes, Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise Comparison of Photo detectors, Fundamental Receiver Operation, preamplifiers, Error Sources, Receiver Configuration, Probability of Error. Quantum Limit.		
Topic - 5	**DIGITAL TRANSMISSION SYSTEM AND MEASUREMENTS**	**9 +3**
Point to Point links System considerations, Power budget, time budget- bandwidth budget calculations, Noise Effects on System Performance-Principles and operation of WDM, Solitons -EDFA - Basic on concepts of SONET/SDH Network. Principles of OTDR, Attenuation and dispersion, Field Measurements.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Gerd Keiser, Optical Fiber Communication, McGraw-Hill International, Singapore, 5th edition. 2013
2	J.Gower, Optical Communication System, Prentice Hall of India, 2001. Copy right 2002
3	J.H. Franz, V.K. Jain, Optical Communication-Components and Systems, Narosa Publishing House, 2000
4	J.Senior, Optical Communication, Principles and Practice, Prentice Hall of India, Third edition published 2009.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=pavBq7HIoIE
2	https://www.youtube.com/watch?v=EreQPmHANmg
3	https://www.youtube.com/watch?v=Pb2CrmCgmkQ
4	https://www.youtube.com/results?search_query=FIBER+OPTICAL+RECEIVERS
5	https://www.youtube.com/watch?v=rOZOa8MHll8

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	Common to B.E. ECE & B.E. EEE	20ECCLT1	EMBEDDED SYSTEMS	2	0	4	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Evaluate the major tools of abstraction in the embedded system design process.	K2	1
CO2	Elaborate the working functionality of LPC 214X Family Peripherals based on the hardware architecture, memory organization and other attributes of ARM processor.	K3	2
CO3	Analyze the hardware and software platform used for embedded computing.	K3	3
CO4	Explain how the process and the operating system used to build applications with more complex functionality and much greater flexibility to satisfy timing requirements.	K4	4
CO5	Classify the important features that are essential for the successful completion of large embedded system projects.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		1		2	1			1	3	3		3	2	
CO2		1		2	2			1	3	3		3	1	
CO3		1		2	2			1	3	3		3	1	2
CO4		2		2	2			1	3	3		3	1	1
CO5		2		2				1	3	3		3	2	1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment & Model Practical Examination
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS**	**6**
Introduction – Embedded system design process –Design example: Model train controller- Design methodologies- Design flows – Requirement Analysis -System analysis and architecture design – Quality Assurance techniques. .		
Topic - 2	**ARM PROCESSOR AND PERIPHERALS**	**6**
Instruction sets preliminaries – ARM Processor – CPU: programming input and output- supervisor mode, exceptions and traps - Memory system mechanisms – CPU performance- CPU power consumption-.		
Topic - 3	**EMBEDDED COMPUTING PLATFORM DESIGN**	6
Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization –		
Topic - 4	**PROCESSES AND OPERATING SYSTEMS**	**6**
Introduction – Multiple tasks and multiple processes – Preemptive real-time operating systems- Priority based scheduling- Interprocess communication mechanisms –- Power optimization strategies for processes		
Topic - 5	**SYSTEM DESIGN TECHNIQUES AND NETWORKS**	**6**
Multi processors-CPUs and Accelerators -Distributed embedded systems – Networks for Embedded Systems:-I2C, -Internet enabled systems-Elevator controller.		

THEORY	**30**		**TUTORIAL**			**PRACTICAL**	**0**		**TOTAL**	**30**

COURSE CONTENT	
1	Interfacing interrupt.
2	Interfacing ADC
3	Interfacing LED and PWM.
4	Interfacing real time clock
5	Interfacing keyboard and LCD.
6	Interfacing EPROM.
7	Mailbox.
8	Interfacing serial port
9	Flashing of LEDS.
10	Interfacing temperature sensor.
11	Interfacing PWM.

12	External Interrupt.
13	Interfacing Zigbee Protocol Node A & Node B.
14	Interfacing Stepper Motor.

THEORY	**0**		**TUTORIAL**	**0**		**PRACTICAL**	**60**		**TOTAL**	**60**

BOOK REFERENCES	
1	Marilyn Wolf, "Computers as Components – Principles of Embedded Computing System Design", Third Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
2	K.V.Shibu, "Introduction to Embedded Systems", McGraw Hill,2nd Edition, 2017
3	Prasad.K.V.K.K, Embedded Real-Time Systems: Concepts, Design & Programming, Dreamtech
4	Embedded & Real Time System : - Al-Ameen Publication, 2020

OTHER REFERENCES	
1	Nptel video https://nptel.ac.in/courses/106/105/106105159/, "Introduction to Embedded Systems", Dr.AnubamBasu, Computer Science Engineering, IIT Kharagpur.
2	Nptel video https://nptel.ac.in/courses/108/102/108102169/ , "Introduction to Embedded System Design", Prof.Badri N Subudhi& Prof. Dhananjay V. Gadre, Electrical Engineering, IIT, Jammu.
3	https://youtu.be/d5duBWX71M4

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E. ECE	20EC7L1	RF AND MICROWAVE LABORATORY	0	0	2	1

COURSE LEARNING OUTCOMES (COs)		
After Successful completion of the course, the students should be able to		RBT Level
CO1	Understand the Characteristics of diodes	K3
CO2	Analysis of microwave network parameters	K3
CO3	Understand the Measurement of BER and losses in optical fiber cable.	K4
CO4	Analysis of Scattering parameters	K4
CO5	Design and Simulation of RF filter and microwave couplers.	K3

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	2	3	3	3	2	3	2
CO2	3	3	3	3	3	2	2	2	3	3	3	2	3	2
CO3	3	3	3	3	3	2	2	2	3	3	3	2	3	2
CO4	3	3	3	3	3	2	2	2	3	3	3	2	3	2
CO5	3	3	3	3	3	2	2	2	3	3	3	2	3	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Laboratory Record
	2	Model Practical Examinations
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

LIST OF EXPERIMENTS	
1	Characteristics of reflex klystron
2	Characteristics of Gunn diode
3	Scattering parameters of Microwave Tee junctions
4	Characteristics of Directional coupler
5	Analysis of microwave network parameters (Attenuation, Impedance, frequency and VSWR measurement).
6	D.C. Characteristics of LED and PIN Photo Diode
7	WDM using Fiber Optic Passive Component Module and Dual Source Kit
8	BER measurement Advanced Fiber optic communication Trainer kit.
9	Measurement of losses in optical fiber cable.
10	Design and Simulation of RF filter.
11	Design and Simulation of microwave couplers.

THEORY	0		TUTORIAL	0		PRACTICAL	30		TOTAL	30

BOOK REFERENCES	
1	"RF and Microwave Laboratory Manual", Al-Ameen Publications, 2020

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=pGdr9WLto4A&list=PL1CE5B4FFFA997E5D
2	https://www.youtube.com/watch?v=FtEShPAFpek&list=PL_mruqjnuVd87sjSDVS9wuit9CSpgIIfx
3	https://www.youtube.com/watch?v=UWQuMnWcmwc
4	https://www.youtube.com/watch?v=W1cTpqM9DaU
5	https://www.youtube.com/watch?v=8kcvyoHsXrw

Semester	Programme	Course Code	Course Name	L	T	P	C
VII	B.E. ECE, CSE B.Tech. IT	HX8001	PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP	0	0	6	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Upskill in emerging technologies and apply to real industry-level use cases	K5	1,2,3
CO2	Understand agile development process	K2	4
CO3	Develop career readiness competencies, team skills / Leadership qualities	K4	5
CO4	Develop time management, project management skills and communication skills	K4	5
CO5	Use critical thinking for innovative problem solving -	K3	6

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	2	-	3	3	3	1	-	1	3
CO2	3	3	2	2	3	2	-	3	3	3	1	2	2	3
CO3	3	3	3	2	2	1	-	3	3	3	1	-	2	3
CO4	3	3	3	2	2	3	1	3	3	3	3	3	1	3
CO5	3	3	3	3	3	2	-	3	3	3	2	3	1	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Model Practical Examination
	2	Record
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Choosing a project	Selecting a project from the list of projects categorized various technologies & business domains	**2**
Team Formation	Students shall form a team of 4 members before enrolling to a project. Team members shall distribute the project activities among themselves.	**1**
Hands on Training	Students will be provided with hands on training on selected technologies in which they are going to develop the project.	**2**
Project Development	Project shall be developed in agile mode. The status of the project shall be updated to the mentors via appropriate platform.	**6**
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the Project deliverables are to uploaded to cloud based repository such as GitHub.	**3**
Mentor Review and Approval	Mentor will be reviewing the Project deliverables as per the milestone schedule and the feedback will be provided to the team.	**1**
Evaluating and Scoring	Evaluators will be assigned to the team to evaluate the Project deliverables, and the scoring will be provided based on the evaluation metrics	**1**

THEORY	**0**	**TUTORIAL**	**0**	**PRACTICAL**	**30**	**TOTAL**	**30**

OTHER REFERENCES	
1	https://careereducation.smartinternz.com/

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. ECE	20EC5E1	TRANSMISSION LINES AND WAVEGUIDES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the characteristics of transmission lines and its losses	K2	1
CO2	Explain the standing wave ratio and input impedance in high frequency transmission lines	K2	2
CO3	Analyze impedance matching by stubs using smith charts	K4	3
CO4	Analyze the passive filters with different frequencies	K4	4
CO5	Analyze the characteristics of TE and TM waves	K4	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		3	1			1	3	3		3		1
CO2	2	2		3	1			1	3	3		3		
CO3	2	2		2	2			1	3	3		3	1	1
CO4	2	2		2	2			1	3	3		3	1	
CO5	2	2		2	2			1	3	3		3	1	1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignments
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**TRANSMISSION LINE THEORY**	**9**
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 Z_0 - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.		
Topic - 2	**HIGH FREQUENCY TRANSMISSION LINES**	**9**
Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current onthe 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 - Reflection losses - Measurement of VSWR and wavelength		
Topic - 3	**IMPEDANCE MATCHING IN HIGH FREQUENCY LINES**	**9**
Impedance matching: Quarter wave transformer - Impedance matching by stubs - Single stub and double stub matching - Smith chart - Solutions of problems using Smith chart - Single and double stub matching using Smith chart.		
Topic - 4	**PASSIVE FILTERS**	**9**
Characteristic impedance of symmetrical networks - filter fundamentals, Design of filters: Constant K - Low Pass, High Pass, Band Pass, Band Elimination, m- derived sections - low pass, high pass composite filters		
Topic - 5	**WAVE GUIDES AND CAVITY RESONATORS**	**9**
General Wave behaviours along uniform Guiding structures, Transverse Electromagnetic waves, Transverse Magnetic waves, Transverse Electric waves, TM and TE waves between parallel plates, TM and TE waves in Rectangular wave guides, Bessel's differential equation and Bessel function, TM and TE waves in Circular wave guides, Rectangular and circular cavity Resonators		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	John D Ryder, “Networks, lines and fields”, 2nd Edition, Prentice Hall India, 2010
2	E.C.Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2006
3	G.S.N Raju "Electromagnetic Field Theory and Transmission Lines" , Pearson Education, Firstedition 2005

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=surDm-x5Uwo
2	https://www.youtube.com/watch?v=H_O6A5NuxsY
3	https://www.youtube.com/watch?v=mpI2AZqoO4g
4	https://www.youtube.com/watch?v=WDK_xXX84m4
5	https://www.youtube.com/watch?v=iijVRWx--wg

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. ECE	20EC5E2	OPTO ELECTRONICS DEVICES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the basics of solid state physics.	K2	1
CO2	Design and implement display devices.	K6	2
CO3	Demonstrate and articulate optoelectronic detection devices	K2	3
CO4	Analyze the various optoelectronic modulators.	K4	4
CO5	Determine optoelectronic integrated circuits.	K5	5

PRE-REQUISITE	Electron Devices

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3		2				1	3	3		3		3
CO2	3	2	2	2				1	3	3		3	2	
CO3	3	3	3	2				1	3	3		3		
CO4	2		2					1	3	3		3	2	2
CO5	2	2	3	2				1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**ELEMENTS OF LIGHT AND SOLID STATE PHYSICS**	**9**
Wave nature of light, Polarization, Interference, Diffraction, Light Source, review of Quantum Mechanical concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.		
Topic - 2	**DISPLAY DEVICES AND LASERS**	**9**
Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold Condition, Laser Modes, Classes of Lasers, Mode Locking, laser applications.		
Topic - 3	**OPTICAL DETECTION DEVICES**	**9**
Photo detector, Thermal detector, Photo Devices, Photo Conductors, Photo diodes, Detector Performance.		
Topic - 4	**OPTOELECTRONIC MODULATOR**	**9**
Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acoustoptic devices, Optical, Switching and Logic Devices.		
Topic - 5	**OPTOELECTRONIC INTEGRATED CIRCUITS**	**9**
Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Pallab Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., New Delhi, 2006.
2	Jasprit Singh, “Opto Electronics – As Introduction to Materials and Devices”, Mc Graw-Hill International Edition, 1998
3	J. Wilson and J.Hawkes, “Opto Electronics – An Introduction”, Prentice Hall, 1995
4	S C Gupta, Opto Electronic Devices and Systems, Prentice Hal of India, 2005.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=J6ES-sW8Eig
2	https://www.youtube.com/watch?v=mtAcrB9JrhA
3	https://www.youtube.com/watch?v=WWjldCmRteg
4	https://www.youtube.com/watch?v=K6ewdRw329s
5	https://www.youtube.com/watch?v=m1gCBJ8jshU

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. ECE	20EC5E3	SOFT COMPUTING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Effectively use existing software tools to solve real problems using a soft computing approach.	K1	1
CO2	Classify fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic.	K2	2
CO3	Identify appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications.	K3	3
CO4	Identify and explain neuro-fuzzy systems for classification and prediction in the diagnosis of different types of medical disorders.	K4	4
CO5	Explain the principles of underlying Evolutionary Computation in general and Genetic Algorithms in particular application.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – weak, 2 – medium, 3 – strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	2		2	1	3	3		3		
CO2	3	2	2	2	2			1	3	3		3		2
CO3	3	1	2	2	2		2	1	3	3		3		2
CO4	2	3	2	2	2			1	3	3		3		
CO5	2	2	3	1	2		2	1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**NEURO-FUZZY AND SOFT COMPUTING**	**9**
Introduction – Soft Computing Constituents and Conventional Artificial Intelligence – From Conventional AI to Computational Intelligence – Neural Networks – Fuzzy Set Theory – Evolutionary Computation – Neuro-Fuzzy and Soft Computing Characteristics.		
Topic - 2	**FUZZY LOGIC**	**9**
Introduction to Fuzzy logic, Classical sets and Fuzzy Sets – Classical Relations and Fuzzy Relations – Membership Functions – Fuzzy Rules and Fuzzy Reasoning – Fuzzy Decision Making.		
Topic - 3	**NEURAL NETWORKS**	**9**
Supervised Learning Neural Networks: Perception Networks – Adaptive Linear Neuron – Multiple Adaptive Linear Neuron – Back Propagation Network – Radial Basis Function Networks – Unsupervised Learning Neural Networks: Fixed Weight Competitive Nets – Kohonen Self-Organizing Networks – Learning Vector Quantization – Adaptive Resonance Architectures.		
Topic - 4	**NEURO-FUZZY MODELING**	**9**
Adaptive Neuro-Fuzzy Inference Systems: Architecture – Hybrid Learning Algorithm – Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling: Framework – Neuro-fuzzy modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control : Feedback Control Systems and Neuro-Fuzzy Control – Expert Control – Back propagation Through Time and Real Time Recurrent Learning.		
Topic - 5	**GENETIC ALGORITHMS**	**9**
Basic Concepts – working principle – Basic operators – Basic Terminologies in GA – encoding – fitness function and reproduction – Genetic modeling: Inheritance operator – cross over – inversion & deletion – mutation operator – Bitwise operator – Applications of GA– Differences & similarities between GA & other traditional methods.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Jyh – Shing Roger Jang, Chuen – Tsai Sun, EijiMizutani, “Neuro – Fuzzy and Soft Computing”, Prentice – Hall of India Learning Pvt. Ltd., 2003.
2	S.Rajasekaran, G. A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithm”, PHI Learning Pvt. Ltd., 2003.
3	S. N. Sivanandam, S.N. Deepa, “Principles of Soft Computing”, John Wiley & Sons, 2011.
4	George J. Klir and Bo Yuan, “Fuzzy sets and fuzzy logic – theory and applications”, Prentice hall, 1995.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=mV5vNaXypwc
2	https://www.ibm.com/in-en/cloud/learn/neural-networks
3	https://www.youtube.com/watch?v=rln_kZbYaWc
4	https://www.youtube.com/watch?v=7C19X6pJEuU
5	youtube.com/watch?v=7C19X6pJEuU

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. ECE	20EC5E4	MICROCONTROLLER BASED AUTOMATION	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Comprehend the architecture and concepts of PIC microcontroller	K2	1
CO2	Illustrate the working principle of internal peripherals in PIC microcontroller and its applications	K2	2
CO3	Apply embedded C programming skills for on-chip peripherals in real applications using PICmicrocontroller	K3	3
CO4	Develop embedded C program for automation process in boilers and conveyor belt based LPG cylinderfilling	K1	4
CO5	Build embedded C program for digital Alarm clock through I2C protocol and Speed Control using DCmotor for electric vehicles.	K3	4

PRE-REQUISITE	MICROPROCESSORS AND MICROCONTROLLERS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		1			1	1	3	3	1	3	1	1
CO2	3	2	1	1	1	1	1	1	3	3	1	3	2	1
CO3	3	2	1	1	3	1	1	1	3	3	1	3	2	1
CO4	3	2	1	1	3	1	1	1	3	3	2	3	3	2
CO5	3	2	3	1	3	1	1	1	3	3	3	3	3	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**Introduction to 8 bit Microcontroller**	**9**
Architecture of PIC 16F877A- Register file structure -CPU Register- Status Register- Instruction sets- Addressing modes -Simpleprograms using ALP- Oscillator and reset circuits		
Topic - 2	**Memory Organization**	**9**
Program memory- Data memory- On-chip Peripherals: Timers-Compare-Capture and PWM Modules-Interrupts-Watchdog timer		
Topic - 3	**PIC Programming in C**	**9**
Simple I/O port programming-LED-7 segment-switch-Timer programming-ADC-USART.		
Topic - 4	**Case Studies**	**9**
Automation in boilers - Temperature, Pressure, Water level-display in LCD-Automation in conveyor belt based LPG cylinder filling - cylinder count - weight - sealing-display in 7 segment		
Topic - 5	**Case Studies**	**9**
Digital Alarm clock using real time clock interfacing through I2C protocol-time, date, day, alarm time-display in LCD-DC motor based speed control for electric vehicles- speed and direction control		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Peatman & John B, "Design with PIC Microcontrollers", 1st Edition, Pearson Education, New Delhi, 2009.
2	Myke Predko, "Programming and customizing the PIC Microcontroller", 3rd Edition, Tata Mcgraw Hill, Delhi, 2008.

OTHER REFERENCES	
1	https://circuitdigest.com/microcontroller-projects/bluetooth-controlled-home-automation-using-8051
2	https://www.youtube.com/watch?v=ZkQdN2uliCo
3	https://www.electronicshub.org/rf-based-home-automation-using-8051/
4	https://www.youtube.com/watch?v=So0t4cPdlVE
5	https://www.youtube.com/watch?v=YGOxPPSfduY

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. ECE	20EC5E5	MEDICAL ELECTRONICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the concepts of Electro-Physiology and Bio-Potential Recording	K4	1
CO2	Demonstrate Bio medical and non electrical parameter measurement	K2	2
CO3	Apply the concepts of Assist Devices in medical treatment	K3	3
CO4	Examine the concepts of Biotelemetry and physical medicine	K4	4
CO5	Describe the recent trends in Medical Instrumentation	K2	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1			2	2	3	3		3	1	
CO2	3	2	3	1			2	2	3	3		3	1	
CO3	2	2	1	2			2	2	3	3		3	1	
CO4	3	1	1	2			2	2	3	3		3	1	
CO5	1	3	3	1			2	2	3	3		3	1	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING**	**9**
The Origin of Bio-potentials; bio potential electrodes, biological amplifiers, ECG, EEG, EMG, lead systems and recording methods-typical waveform and signal characteristics.		
Topic - 2	**BIO- CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT**	**9**
PH, PO2,PCO2,Electrophoresis,colorimeter, Autoanalyzer, Blood flow meter, Cardiac output, respiratory measurement, Blood pressure, Temperature.		
Topic - 3	**ASSIST DEVICES**	**9**
Cardiac pacemakers, DC Defibrillator, Dialyzer, Heart lung machine.		
Topic - 4	**PHYSICAL MEDICINE AND BIOTELEMETRY**	**9**
Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry principles, elements and its advantages, radio-pill		
Topic - 5	**RECENT TRENDS IN MEDICAL INSTRUMENTATION**	**9**
Thermograph, Endoscopy Unit, Lasers in medicine, Electrical safety in medical Equipment Patient monitoring system.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Leislie Cromwell, Bio medical Instrumentation and Measurement,PHI,2007
2	David Prutchi and Michael Norris, Design and Development of Medical Electronic Instrumentation : A Practical perspective of the design construction and test of Medical Device, 2004.
3	RS Khandpur, Hand book of Bio medical Instrumentation, Tata McGraw-Hill,200

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=O0CHWFc-gO8
2	https://youtu.be/QnLRl96fqf4
3	https://www.youtube.com/watch?v=T_iYsVohkz4
4	https://www.youtube.com/watch?v=O8dJ77Xz_IQ
5	https://www.youtube.com/watch?v=-633zoLcHHo

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E.ECE	20EC5E6	MODERN ELECTRONIC INSTRUMENTATION	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Use different measuring instruments and sensors	K3	1
CO2	Understand the working principle of various transducers for real time applications	K2	2
CO3	Develop programs for virtual systems using Lab VIEW	K3	3
CO4	Design virtual system using the features of Lab VIEW	K3	4
CO5	Build ladder diagram for industrial applications	K3	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1		1	3	2	3	3	3	3	3	2	
CO2	2	1				3	2	3	3	3	3	3	3	1
CO3	3	2	1		3	3	2	3	3	3	3	3	3	2
CO4	3	2	1		3	3	2	3	3	3	3	3	3	2
CO5	3	2	1		3	3	2	3	3	3	3	3	2	2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Mini Project
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**I MEASUREMENT CONCEPTS AND MEASURING INSTRUMENTS**	**9**
Measurement systems- Static and dynamic characteristics – Units and standards of measurements – Error analysis – Moving coil – Torque equations - DC Ammeters-DC Voltmeters-Digital meters: Wattmeter-Energy meters – Bridge measurements: Maxwell- Kelvin- Schering.		
Topic - 2	**TRANSDUCERS**	**9**
Strain gauge- Thermistor - Humidity sensor- Variable reluctance transducers – Linear variable differential transformer- Capacitive transducer – Piezoelectric transducers – Vibration sensor– Proximity sensor- Optoelectronic transducers Implementation of Instrumentation amplifier with sensor.		
Topic - 3	**VIRTUAL INSTRUMENTATION & SOFTWARE**	**9**
Block diagram of a virtual instrument – Physical quantities and analog interfaces - Hardware and software – User interfaces – Advantages– Architecture of a virtual instrument and its relation to the operating system – Lab VIEW – Graphical user interfaces - Controls and indicators.		
Topic - 4	**VI SOFTWARE TOOLS & PROGRAMMING TECHNIQUES**	**9**
Editing, debugging and running a virtual instrument – Graphical programming palettes and tools – Front panel objects – Function and libraries– VI and sub-VI Decision structures - Formula nodes – Sequence structures – Arrays and clusters – String and file I/O – High level and Low level file I/Os – Attribute nodes- Local and global variables.		
Topic - 5	**PLC PROGRAMMING**	**9**
PLC: Evolution – Components of PLC – Advantages over relay logic – PLC programming languages – Ladder diagram – Programming timers and counters –PLC specifications – Timer functions: Types, Programming - Counter functions: Types, Programming		

THEORY	**45**		**TUTORIAL**			**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Helfrick Albert D. and Cooper William D., ―Modern Electronic Instrumentation and Measurement Techniques, 2nd Edition, PHI Learning, New Delhi, 2003, I,II
2	Jeffery Travis and Jim Kring, ―LabVIEW for Everyone: Graphical programming made easy and Fun, 3rd Edition, Pearson Education, India, 2009.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=xLjk5DrScEU
2	https://www.youtube.com/watch?v=nSeW3R2hr1A
3	https://www.youtube.com/watch?v=Ss-7ZtlHzi4
4	https://www.youtube.com/watch?v=9JoLOHAQ5AA
5	https://www.youtube.com/watch?v=y2eWdLk0-Ho

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. ECE	20EC5E7	ELECTRONICS CIRCUIT BOARD DESIGN	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Describe the PCB design rules and consideration	K2	1
CO2	Apply the PCB Design rules to design and simulate single layer PCB	K3	2
CO3	Prepare Gerber file for a single layer PCB for a given circuit	K3	3
CO4	Construct and verify the working of a single layer PCB using simulation software	K3	4
CO5	Carry out steps to fabricate single layer PCB	K3	5

PRE-REQUISITE	ELECTRONIC CIRCUITS

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1				1	3	3		3	3	3
CO2	3	2	2	1	3			1	3	3		3	2	3
CO3	3	2	2	1	3			1	3	3		3	3	3
CO4	3	2	3	1	3			1	3	3		3	2	3
CO5	3	3	2	2	3			1	3	3		3	2	3

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO PCB DESIGNING CONCEPTS**	**9**
Types of Components used in PCB, Terminologies in PCB Designing, Types of PCBs: Single Sided (Single Layer),Double Layer and Multi-Layer PCB, Flexible PCB, Materials for PCB manufacturing.		
Topic - 2	**PCB DESIGN CONSIDERATIONS**	**9**
PCB Design flow, General, Mechanical and Electrical considerations, Design rules for Analog, Digital and High frequency circuits. Electromagnetic interference/ Compatibility (EMI/ EMC).		
Topic - 3	**DESIGN AND SIMULATION OF PCB**	**9**
Electronic Design Automation (EDA) Tools – Single layer PCB, Two layer PCB. Circuit Design and simulation, creating footprint, placement and routing, Generating Gerber file for single layer PCB.		
Topic - 4	**PCB FABRICATION TECHNIQUES**	**9**
Image transfer techniques. Plating techniques: Immersion, Electro less, Electroplating, Solder Mask, Etching techniques, Mechanical operations		
Topic - 5	**CIRCUIT TRACING AND TESTING & CASE STUDIES**	**9**
Soldering techniques, Testing PCB, Environmental concern. Case studies - Power supply, Token Counter, Wien-bridge Oscillator		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Mehta S D, Electronic Product Design: Volume 1 – Basics of PCB Design, 1st, S Chand Publications, NewDelhi, 2011
2	Clyde Coombs, Printed Circuits Handbook, 7th, McGraw Hill Professional, New Delhi, 2016.
3	Khandpur R S, Printed Circuit Board: Design, Fabrication, Assembly and Testing, 1st, McGraw Hill Education Pvt.Ltd., New Delhi, 2017

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=59Io2Moz8G4
2	https://www.youtube.com/watch?v=_GVk_hEMjzs
3	https://www.youtube.com/watch?v=8ZgAooUkbEY
4	https://www.youtube.com/watch?v=_RBDELs5lN4
5	https://www.youtube.com/watch?v=bBRv7t5t1-c

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. ECE	20EC5E8	ADVANCED DIGITAL SIGNAL PROCESSING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	To have in-depth knowledge on random signal and its spectrum estimation.	K2	1
CO2	To design adaptive filters	K3	2
CO3	To have in-depth knowledge on multirate DSP systems.	K3	3
C04	To have in-depth knowledge eon multivalve DSP systems.	K2	4
C05	To have in-depth knowledge on MATLAB implementation in DSP systems.	K3	5

PRE-REQUISITE	- DIGITAL SIGNAL PROCESSING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2					1	1	3	3		3	2	
CO2	1		3					1	3	3		3	2	
CO3	2		1					1	3	3		3	2	
CO4	1	2	3					1	3	3		3	2	
CO5	1	2	3					1	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**DISCRETE RANDOM SIGNAL PROCESSING:**	**9**
Weiner Khitchine relation - Power spectral density – filtering random process, Spectral Factorization Theorem, special types of random process – Signal modeling-Least Squares method, Pade approximation, Prony's method, iterative Prefiltering, Finite Data records, Stochastic Models.		
Topic - 2	**SPECTRUM ESTIMATION**	**9**
Non-Parametric methods - Correlation method - Co-variance estimator - Performance analysis of estimators – Unbiased consistent estimators –Period gram estimator –Barlett spectrum estimation - Welch estimation - Model based approach - AR, MA, ARMA Signal modeling -Parameter estimation using Yule-Walker method.		
Topic - 3	**LINEAR ESTIMATION AND PREDICTION**	**9**
.Maximum likelihood criterion - Efficiency of estimator - Least mean squared error criterion - Wiener filter - Discrete Wiener Hoff equations - Recursive estimators - Kalman filter - Linear prediction, Prediction error - Whitening filter, Inverse filter - Levinson recursion		
Topic - 4	**ADAPTIVE FILTERS**	**9**
FIR Adaptive filters - Newton's steepest descent method - Adaptive filters based on steepest descent method - Widrow Hoff LMS Adaptive algorithm - Adaptive channel equalization - Adaptive echo canceller - Adaptive noise cancellation - RLS Adaptive filters – Exponentiallyweighted RLS - Sliding window RLS - Simplified IIR LMS Adaptive filter		
Topic - 5	**MULTIRATE DIGITAL SIGNAL PROCESSING**	**9**
Mathematical description of change of sampling rate - Interpolation and Decimation - Continuous time model - Direct digital domain approach - Decimation by integer factor - Interpolation by an integer factor		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Sophoncles J. Orfanidis, "Optimum Signal Processing ", McGraw-Hill, 2000.
2	John G.Proakis, Dimitris G.Manolakis, "Digital Signal Processing", Prentice Hall of India, New Delhi, 2005.
3	S. Kay," Modern Spectrum Estimation Theory And Application", Prentice Hall, Englehood Cliffs, Nj1988.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=Lgdr9WLto4A&list=PL1CE5B4FFFA997E5D
2	https://www.youtube.com/watch?v=FtEShPAFpek&list=PL_mruqjnuVd87sjSDVS9wuit9CSpgIIfx
3	https://www.youtube.com/watch?v=UWQuMnWcmwc
4	https://www.youtube.com/watch?v=W1cTpqM9DaU
5	https://www.youtube.com/watch?v=8kcvyoHsXrw

Semester	Programme	Course Code	Course Name	L	T	P	C
V	B.E. ECE	20EC5E9	COMPUTER ARCHITECTURE	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Identify the different addressing modes used in a processor.	K3	1
CO2	Distinguish micro programmed control and Hardwired Control.	K4	2
CO3	Classify the control units present in a processor	K2	3
CO4	Analyze the various performance enhancement techniques of Cache memories.	K4	4
CO5	Classify the memory management requirements.	K2	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2						1	3	3		3		
CO2	3		2					1	3	3		3	2	
CO3	3	3						1	3	3		3		
CO4	3	3						1	3	3		3		
CO5		3	2					1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic – 1	**BASIC STRUCTUTRE OF COMPUTERS**	**9**
Functional Units - Basic Operational Concepts - Bus Structures - Performance - Memory Locations and Addresses - Memory Operations - Instruction and Instruction Sequencing – Addressing Modes - Basic I/O Operations.		
Topic - 2	**ARITHMETIC UNIT**	**9**
Addition and Subtraction of Signed Numbers - Design of Fast Adders - Multiplication of Positive Numbers - Signed Operand Multiplication - Fast Multiplication - Integer Division - Floating Point Numbers and Operations		
Topic - 3	**BASIC PROCESSING UNIT**	**9**
Fundamental Concepts - Execution of a Complete Instruction - Multiple Bus Organization - Hardwired Control – Micro programmed Control – Microinstructions- Microprogram Sequencing- Wide Branch Addressing		
Topic - 4	**MEMORY SYSTEM**	**9**
Basic Concepts - Speed, Size and Cost - Cache Memories - Performance Considerations - Virtual Memories- memory management requirements.		
Topic - 5	**PIPELINING AND I/O ORGANIZATION**	**9**
Basic Concepts - Data Hazards - Instruction Hazards – Influence on instruction sets - Data path and control considerations - Superscalar operation – Accessing I/O devices- Interrupts – Enabling and disabling interrupts- Handling multiple devices - Direct Memory Access. Case study - ARM interrupt structure		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Carl Hamacher, ZvonkoVranesic and SafwatZaky, “Computer Organization”, 5th Edition, McGraw-Hill,2014.
2	John P.Hayes, “Computer Architecture and Organization”, 3rdEdition, McGraw Hill, 2010.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=GRInNLx3Tug
2	https://online.princeton.edu/computer-architecture
3	https://www.youtube.com/watch?v=Ol8D69VKX2k
4	https://www.youtube.com/watch?v=HEjPop-aK_w
5	https://www.youtube.com/watch?v=c3mPdZA-Fmc

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. ECE	20ECCE1	DIGITAL IMAGE PROCESSING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the fundamental concepts of a digital image processing.	K2	1
CO2	Compare various Image Transform Techniques.	K3	2
CO3	Apply enhancement and restoration algorithms for image analysis.	K3	3
CO4	Choose appropriate segmentation algorithms for given application.	K4	4
CO5	Compare various Image compression techniques.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2						1	3	3		3	2	
CO2	1		3					1	3	3		3	2	
CO3	2		1			1		1	3	3		3	2	
CO4	1	2	3					1	3	3		3	2	
CO5	1	2	3					1	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**DIGITALIMAGEFUNDAMENTALS**	**9**
Elements of visual perception – Image sensing and acquisition – Image Formation Model, Image Sampling and Quantization, Representation of Digital Images, Spatial and Gray level Resolution, Zooming and Shrinking of Digital Images, Basic relationship between pixels		
Topic - 2	**IMAGETRANSFORMS**	**9**
1D and 2D image transforms - Separable Transforms - One dimensional Fourier Transform - DFT – Two-dimensional Fourier Transform-Discrete Cosine Transform-Walsh–Hadamard Transform – Wavelet transform –discrete and continuous - Haar transform– Properties.		
Topic - 3	**IMAGEENHANCEMENTANDRESTORATION**	**9**
Image Enhancement: Spatial Domain Methods. Image subtraction–Image averaging– Spatial filtering - Smoothing, Sharpening filters–First and Second Derivatives–Histogram–Histogram–Equalization Frequency Domain Methods–Filtering-Smoothing and Sharpening–Butterworthfilter Image Restoration: Model of image Degradation / Restoration process.		
Topic - 4	**IMAGESEGMENTATIONANDREPRESENTATION**	**9**
Detection of discontinuities - Point, Line and Edge detection – Gradient operators - Edge linking – Graph theoretic technique – Thresholding – global and adaptive –Region - based segmentation. Boundary representation – chain codes - Polygonal approximation–Signatures–skeletons.		
Topic - 5	**IMAGECOMPRESSION**	**9**
Introduction to image compression – Lossy and Lossless compression–Sequential and Progressive Compression – Rate / Distortion optimization – compression metrics – Huffman c o d i n g–Run Length Coding – Predictive coding – DPCM - T r a n s f o r m c o d i n g – Vector quantization-Image compression standards.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	R.C.Gonzalez, R.E.Woods, “Digital Image Processing”, Pearson Education, 4th Edition,2017.
2	Anil K. Jain, “Fundamentals of Digital Image Processing” Pearson Education, 1st edition, 2015.
3	David Salomon,“Data Compression”, SpringerVerlagNewYorkInc., 4th Edition،2006.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=Lgdr9WLto4A&list=PL1CE5B4FFFA997E5D
2	https://www.youtube.com/watch?v=FtEShPAFpek&list=PL_mruqjnuVd87sjSDVS9wuit9CSpgIIfx
3	https://www.youtube.com/watch?v=UWQuMnWcmwc
4	https://www.youtube.com/watch?v=W1cTpqM9DaU
5	https://www.youtube.com/watch?v=8kcvyoHsXrw

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. ECE	20EC6E3	FUNDAMENTALS OF NANO ELECTRONICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Illustrate nano electronics device architectures and interface engineering at atomic level.	K1	1
CO2	Discuss the types of nano-materials and fabrication methods of nanostructures.	K2	2
CO3	Explain electron transport in nanostructures using quantum mechanics theory.	K3	3
CO4	Illustrate nano electronic devices constructed using tunnelling mechanism.	K4	4
CO5	Explain nano MOSFETs with its shrink down approaches and nano devices like Single Electron Transistors, Carbon nano tube transistors, Semiconductor nano wire SETs and FETs-Molecular SETs and molecular electronics-Quantum dot cellular automata.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2					2	1	3	3		3		
CO2		2	2		2			1	3	3		3	2	
CO3				2			2	1	3	3		3	2	
CO4	2		2		2			1	3	3		3	2	
CO5	2	2			2		2	1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**PHYSICS OF NANOELECTRONICS**	**9**
The changing landscape of micro / nano electronics-The region of nanostructures-Beyond CMOS-More than Moore-Classical particles, classical waves-Wave–particle duality, Heisenberg uncertainty principle Electrons behaving as waves (Schrödinger equation)- Scattering and bound states-Atoms to crystals- bands and bonds.		
Topic - 2	**MATERIALS AND FABRICATION OF NANOSTRUCTURES**	**9**
Semiconductors - Semiconductor hetero structures - Lattice-matched hetero structures – Pseudomorphic hetero structures - Organic semiconductors - Carbon nano materials - NanolithographyEtching-Other means for fabrication of nanostructures and nano devices.		
Topic - 3	**ELECTRON TRANSPORT IN NANOSTRUCTURES**	**9**
Time scales of the electrons in solids-length scales of the electrons in solids-Statistics of the electrons in solids and nanostructures: Classical-Statistics of the electrons in solids and nanostructures: Fermi-The density of states of electrons in nanostructures-Classical transport: classical resistance and conductance Quantum ballistic transport: quantum Resistance and conductance-Transport of spin, spintronic devices and applications.		
Topic - 4	**TUNNELING DEVICES**	**9**
Tunnelling through a potential barrier-Potential energy profiles for material interfaces-Metal - insulator, metal – semiconductor-Metal – insulator - metal junctions-Tunnelling diode (TD) and Resonant tunnelling diode (RTD)- Three-terminal resonant tunnelling devices-Technology of RTD-Inverter and logic OR gates based on RTD.		
Topic - 5	**SINGLE ELECTRON AND OTHER NANOELCTRONIC DEVICES**	**9**
Coulomb blockade-Tunnel junction excited by a current source-Performance of the single-electron transistor-SET technology and Field effect transistors-Carbon nano tube transistors (FETs and SETs)-Semiconductor nano wire SETs and FETs-Molecular SETs and molecular electronics-Quantum dot cellular automata.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, “Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications”, Cambridge University Press, 2012.
2	George W. Hanson, “Fundamentals of Nanoelectronics”, Prentice Hall, 2007. 3. Karl Goser, Peter GlÖsekötter, Jan Dienstuhl, “Nanoelectronics and Nanosystems”, Springer, 2004.

OTHER REFERENCES	
1	https://nanohub.org/courses/FON2
2	https://www.coursera.org/lecture/nanotechnology/introduction-to-nano-fabrication-tools-7jeWL
3	https://videoportal.uni-freiburg.de/video/Quantum-Transport-in-Nanostructures/157da162206840382181e328a2bb1d4a
4	https://www.youtube.com/watch?v=GJxHvOfwJnQ
5	https://www.youtube.com/watch?v=asEvPyfFhF0

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. -ECE	20EC6E4	MOBILE COMMUNICATION	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the cellular concept and its coverage with capacity improvement techniques.	K2	1
CO2	Characterize the propagation models and channel models	K5	2
CO3	Illustrate the effects of multipath propagation and the compensation by diversity and equalization	K3	3
CO4	Elaborate the concepts of multiple access techniques for real world problems	K2	4
CO5	Interpret the characteristics of 4G wireless networks	K2	5

PRE-REQUISITE	ANALOG & DIGITAL COMMUNICATION

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2					1	3	3		3		1
CO2	3	2	1	1	1			1	3	3		3		1
CO3	2	1	3		2			1	3	3		3	1	
CO4	3	1						1	3	3		3	1	
CO5	3							1	3	3		3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**CELLULAR CONCEPT**	**9**
Frequency reuse–Channel assignment strategies, Handoff strategies, Interference and system capacity, Co-channel interference and system capacity- improving coverage and capacity		
Topic - 2	**PROPAGATION MODELS AND CHANNEL MODELS**	**9**
Large Scale Propagation: Free space propagation model- Terrestrial propagation: Reflection- Two ray ground model – Knife edge diffraction model - Scattering model – Outdoor propagation model – Durkin model Small-scale multipath propagation and measurements - Mobile multipath channel parameters - Types of small-scale fading- Rayleigh and Rician channel models		
Topic - 3	**EQUALIZERS AND DIVERSITY TECHNIQUES**	**9**
Introduction to equalization, A generic adaptive equalizer, Linear equalizers, nonlinear equalizers- Equalizer algorithms – Zero forcing- Least mean square- Selection diversity, Maximum Ratio diversity - RAKE receiver		
Topic - 4	**MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATIONS**	**9**
FDMA-TDMA- Spread spectrum multiple access-Capacity of cellular CDMA – SDMA- WCDMA- Packet radio protocols- Capture effect in packet radio		
Topic - 5	**4G WIRELESS COMMUNICATION**	**9**
System Architecture Evolution – Architecture of LTE: High Level Architecture, User Equipment, Evolved UMTS Terrestrial Radio Access Network, Evolved Packet Core, Roaming Architecture–OFDMA in a Mobile Cellular Network: Multiple Access, Fractional Frequency Re-Use, Channel Estimation– SCFDMA		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Rappaport S. Theodore, ―Wireless Communications, 2nd Edition, Pearson Education, 2010
2	Christopher Cox. An Introduction to LTE: LTE, LTE Advanced, SAE, VoLTE and 4G Mobile Communications, 2nd Edition, Wiley Publications, New Delhi, 2014
3	Saad Z. Asif. 5G Mobile Communications Concepts and Technologies, 1st Edition, CRC Press Taylor & Francis Group, USA, 2019.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=wSrYSUGUwR8
2	https://www.youtube.com/watch?v=XU0yW8MyJkg
3	https://www.youtube.com/watch?v=gDZSJN9OPcI
4	https://www.youtube.com/watch?v=r-RxGQuZLio
5	https://www.youtube.com/watch?v=-ymnQ5rpcYA&list=PLbMVogVj5nJSi8FUsvglRxLtN1TN9y4nx

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. ECE	20EC6E5	COGNITIVE RADIO	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the basics of SDR and how it evolves from Software Defined Radio to Cognitive Radio.	K2	1
CO2	Illustrate the performance of cognitive networks using Cooperative Cognitive Radio andCooperative wireless networks.	K2	2
CO3	Determine the ability to design and implement algorithms for cognitive radio spectrum sensing and dynamic spectrum access	K5	3
CO4	Analyze the functions of MAC layer and Network layer and its various protocols to performingmultiplexing and scheduling tasks in QoS.	K4	4
CO5	Identify the basics of security management and the various attacks & its counter measures to secureRouting Model in Cognitive Radio Network	K2	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2			2				1	3	3		3		2
CO2	3	2	2					1	3	3		3	2	
CO3	3	3	3	2				1	3	3		3		
CO4	2	2	2					1	3	3		3		2
CO5	2	2		2				1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO SOFTWARE DEFINED RADIO**	**9**
Evolution of Software Defined Radio and Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, radio frequency spectrum and regulations.		
Topic - 2	**COGNITIVE RADIO ARCHITECTURE**	**9**
Cognition cycle – orient, plan, decide and act phases, Organization, SDR as a platform for Cognitive Radio – Hardware and Software Architectures, Overview of IEEE 802.22 standard for broadband wireless access in TV bands.		
Topic - 3	**SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS**	**9**
Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection and other approaches, Fundamental Tradeoffs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio..		
Topic - 4	**MAC AND NETWORK LAYER DESIGN**	**9**
MAC for cognitive radios – Polling, ALOHA, slotted ALOHA, CSMA, CSMA / CA, Network layer design – routing in cognitive radios, flow control and error control techniques..		
Topic - 5	**TRUSTED COGNITIVE RADIO NETWORKS**	**9**
Overview of security issues in cognitive radios, auction based spectrum markets in cognitive radio networks, public safety and cognitive radio, cognitive radio for Internet of Things.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Alexander M. Wyglinski, Maziar Nekovee, Thomas Hou, ―Cognitive Radio Communications and Networks‖, Academic Press, Elsevier, 2010.
2	Huseyin Arslan (Ed.), ―Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems, Springer, 2007.
3	Bruce Fette, ―Cognitive Radio Technology‖, Newnes, 2006.
4	Kwang-Cheng Chen, Ramjee Prasad, ― Cognitive Radio Networks‖, John Wiley and Sons, 2009.
5	E. Biglieri, A.J. Goldsmith., L.J. Greenstein, N.B. Mandayam, H.V. Poor, Principles of Cognitive Radio", Cambridge University Press, 2013.

OTHER REFERENCES	
1	https://nptel.ac.in/courses/108/107/108107107/
2	https://www.youtube.com/watch?v=SljXFf0vgvw
3	https://nptel.ac.in/courses/108/107/108107107/
4	https://www.youtube.com/watch?v=09eXRHf6glA

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. ECE	20EC6E9	WIRELESS BROADBAND COMMUNICATION	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Interpret the functioning of fixed and mobile broadband MAC layer functionalities.	K2	1
CO2	Apply suitable QoS framework and resource management of wireless broadband networks.	K3	2
CO3	Comprehend different energy efficient algorithms suitable for wireless broadband networks.	K2	3
CO4	Apply the suitable methods in solving mobility related issues	K3	4
CO5	Comprehend technical issues in Cellular Multi-hop 802.16 Networks	K2	5

PRE-REQUISITE	MOBILE COMMUNICATION, DATA COMMUNICATION AND NETWORKING

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1				3		1	3	3		3		2
CO2	3	2	1					1	3	3		3		1
CO3	3	3	2	2	1		1	1	3	3		3		1
CO4	3	2	1	1				1	3	3		3		
CO5	3	3	2	2	1			1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**WIRELESS MAN**	**9**
Evolution of Broadband Wireless -Spectrum Options for Broadband Wireless-Technical Challenges for Broadband Wireless- Background on IEEE802.16 and WiMAX- Salient Features of WiMAX		
Topic - 2	**MEDIUM ACCESS CONTROL IN WIRELESS MAN**	**9**
Sub layers of the MAC Layer of IEEE 802.16 – Service Flows and Connection – Frame Structure – Open Issues in IEEE 802.16- MAC Layer of ETSI HiperAccess		
Topic - 3	**RADIO RESOURCE MANAGEMENT**	**9**
Mesh Mode Operations – RRM in Tree Topology– RRM in Mesh Topology. QoS in WiMAX Mesh Networks: Services Provisioning-QoS Framework– QoS Scheduling		
Topic - 4	**MOBILITY MANAGEMENT**	**9**
Mobile WiMAX Network - Idle-Mode Management- Anchored Mobility Management- (ASN and CSN). Energy management: PMP and Mesh Modes in IEEE 802.16 WiMAX- Sleep Mode in the IEEE 802.16e- Energy Consumption Analysis with Downlink, Uplink Traffic and Generalized Traffic Process		
Topic - 5	**IEEE 802.16j MULTI-HOP RELAY NETWORKS**	**9**
Overview-Challenges- Tunnelling and Aggregation- Resource Scheduling Methods- Dimensioning Cellular Multi-hop 802.16 Networks		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Yan Zhang and Hsiao-Hwa Chen, "Mobile WiMAX : toward broadband wireless metropolitan area networks", Auerbach Publications, 2008.
2	Jeffrey G. Andrews, Arunabha Ghosh and RiasMuhamed, "Fundamentals of WiMAX: understanding broadband wireless networking", Pearson Education, 2007
3	Kwang-Cheng Chen and J. Roberto B. de Marca, “Mobile WiMAX”, John Wiley & Sons, 2008.
4	Uma ShankerJha and Ramjee Prasad, "OFDM Towards Fixed and Mobile Broadband Wireless Access", Artech House, 2007.

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1	https://www.youtube.com/watch?v=fSTs_F9lHrE
2	https://www.youtube.com/watch?v=G0h0dC4Zycs
3	https://www.youtube.com/watch?v=gwCxVwmHnRw
4	https://www.youtube.com/watch?v=ASU5nT3cTfs
5	https://www.youtube.com/watch?v=T4Q2sRe98f0

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. ECE	20EC6E7	SATELLITE COMMUNICATION	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Identify and explain the orbital parameters, types of orbit and geo-stationary satellite launching method.	K3	1
CO2	Determine the carrier to noise density ratio, link power budget, system noise in satellite link design	K5	2
CO3	Summarize the equivalent isotropic radiated power, antenna noise, saturation flux density and Inter modulation noise for satellite earth segment	K2	3
CO4	Summarize the equivalent isotropic radiated power, antenna noise, saturation flux density and Inter modulation noise for satellite earth segment	K2	4
CO5	Explain the launching procedures, payloads and functions of Chandrayan-1 and Mangalyaan satellites	K2	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3		1			1	3	3		3	2	2
CO2	3	1	1		1			1	3	3		3	1	2
CO3	3	2	2			1		1	3	3		3	1	1
CO4	2		1		1			1	3	3		3	1	
CO5	2	2	2		2	1		1	3	3		3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**SATELLITE ORBITS**	**9**
Kepler‟s Laws – Newton‟s Law – orbital parameters – orbital perturbation – station keeping – geo stationary and non-Geo-stationary orbits – Antenna Look angle – Limits of visibility – eclipse – Sub satellite point – Sun transit outage – Launching Procedure – Launch Vehicles and propulsion		
Topic - 2	**SPACE SEGMENT AND SATELLITE LINK DESIGN**	**9**
Spacecraft Technology – Structure – Primary power – Attitude Control – Station Keeping – Thermal control – Propulsion Subsystem – Telemetry – Tracking and command (TTC) – Transponders and supporting subsystem – Satellite uplink and downlink Analysis and Design – Link power budget equation – E/N calculation – performance impairments – system noise – inter modulation and interference – Propagation Characteristics and Frequency consideration – System reliability and design lifetime		
Topic - 3	**EARTH SEGMENT**	**9**
Introduction – Receive – Only home TV systems – Outdoor unit – Indoor unit for analog (FM) TV – Master antenna TV System – Community antenna TV System – Transmit – Receive earth stations – Equivalent isotropic radiated power – System noise – Antenna noise – Carrier to Noise ratio – Uplink – Saturation flux density – Input back off – The earth station – HPA – Downlink – Output back off – Satellite TWTA output – Effects of rain – Inter modulation noise.		
Topic - 4	**SATELLITE ACCESS**	**9**
Modulation and Multiplexing: Voice, Data, Video – Analog-digital transmission system – Multiple Access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum Communication		
Topic - 5	**SATELLITE APPLICATIONS**	**9**
INTELSAT Series – INSAT – VSAT – Mobile satellite services: GPS – INMARSAT – Satellite Navigational System – Direct to home Broadcast (DTH) – Worldspace services – Business TV (BTV) – GRAMSAT. Case Studies: Chandrayaan -I – Chandrayaan- II – Mangalyaan (MOM)		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Dennis Roddy, “Satellite Communication”, Mc Graw Hill International, 4th Edition 2016
2	Wilbur L.Pritchard,HendriG.Suyderhoud,Robert A.Nelson, “Satellite Communication Systems Engineering”, Prentice Hall/Pearson, Twelfth Impression 2013.
3	Agarwal, “Design of Geosynchronous Space Craft”, Prentice Hall, 1986
4	David Tse and Pramod Viswanath, Fundamentals of Wireless Communication, Cambridge University Press, 2005
5	Bruce R.Elbert, “The Satellite Communication Application”, Hand Book, Artech House Bostan London, 1997
6	Tri T.Ha, “Digital Satellite Communication”, Mc Graw Hill Education, 2nd Edition 200

OTHER REFERENCES	
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2	https://www.youtube.com/watch?v=Hdc4IQIbmQQ
3	https://www.youtube.com/watch?v=_oDZeKTp99I
4	https://www.youtube.com/watch?v=951kYJpozrk
5	https://www.youtube.com/watch?v=PJvK9kGxUKE

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. CSE & ECE B.Tech. IT	20ECCE2	WIRELESS AD HOC AND SENSOR NETWORKS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the fundamentals of wireless communication technology that facilitate the insight of infrastructure less networks formation, application and design issues of the given Ad hoc and Sensor networks	K5	1
CO2	Apply the MAC Protocol designing issues and contention–based algorithms with reservation and scheduling to achieve node mobility, , bandwidth efficiency and QoS support for the given Ad hoc wireless network	K3	2
CO3	Examine the issues behind the routing protocol blueprint and classification in transport layer to suit with Ad hoc Wireless Network.	K4	3
CO4	Apply the MAC layer protocols to emphasize the energy efficient operation, and assignment operations for the Wireless sensor networks	K3	4
CO5	Develop the architecture, data handling and localization techniques to optimize the location discovery of sensor nodes for the given wireless sensor networks.	K6	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2				2	2	3	3		3	1	
CO2	3	2	3				2	2	3	3	2	3		
CO3		2	2				2	2	3	3		3		1
CO4	2	2	2	3			2	2	3	3		3		
CO5	3	3	2			2	2	2	3	3		3	3	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
UNIT 1	**TUNING TO SENSOR NETWORKS FUNDAMENTALS**	**9**
Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the wireless channel – Mobile Ad hoc Networks (MANETs) and Wireless Sensor networks (WSNs): concepts and architectures – Applications of Ad Hoc and Sensor networks – Design Challenges in Ad hoc and Sensor Networks.		
UNIT 2	**MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS**	**9**
Issues in designing a MAC Protocol – Classification of MAC Protocols – Contention based protocols – Contention based protocols with Reservation Mechanisms – Contention based protocols with Scheduling Mechanisms – Multi channel MAC – IEEE 802.11		
UNIT- 3	**ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS**	**9**
Issues in designing a routing and Transport Layer protocol for Ad hoc networks – proactive routing, reactive routing (on – demand), hybrid routing – Classification of Transport Layer solutions – TCP over Ad hoc networks.		
UNIT-4	**WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS**	**9**
Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures – data relaying and aggregation strategies – MAC layer protocols: self – organizing, Hybrid TDMA/FDMA and CSMA based MAC – IEEE 802.15.4 – Case study: Wireless Sensor Network in Sustainable Agriculture		
UNIT- 5	**WSN ROUTING, LOCALIZATION & QOS**	**9**
Issues in WSN routing – OLSR – Localization – Indoor and Sensor Network Localization – absolute and relative localization, triangulation – QOS in WSN – Energy Efficient Design – Synchronization – Transport Layer Issues – Case study: WBAN revisited.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	C. Siva Ram Murthy, and B. S. Manoj, "Ad hoc Wireless Networks: Architectures and Protocols", Prentice Hall Professional Technical Reference,First Edition,2008.
2	Kazem Sohraby, Daniel Minoli, &TaiebZnati, “Wireless Sensor Networks-Technology, Protocols, and Applications”, John Wiley, 2007.
3	Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 2006
4	Feng Zhao and LeonidesGuibas, "Wireless Sensor Networks", Elsevier Publication – 2002.
5	Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003
6	C. Siva Ram Murthy, and B. S. Manoj, "Ad hoc Wireless Networks: Architectures and Protocols", Prentice Hall Professional Technical Reference,First Edition,2008.

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1	https://www.youtube.com/watch?v=qU49jUvxW00
2	https://www.geeksforgeeks.org/responsibilities-and-design-issues-of-mac-protocol/
3	https://snscourseware.org/snscenew/files/1570819850.pdf

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. - ECE	20EC6E8	VLSI SIGNAL PROCESSING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain pipeline based architectures in the design FIR and IIR systems	K2	1
CO2	Demonstrate clocking issues and asynchronous system	K2	2
CO3	Design architectures for DSP algorithms	K6	3
CO4	Improve the speed of digital system through transformation techniques	K6	4
CO5	Minimize the design in terms of area, delay and power	K6	5

PRE-REQUISITE	DIGITAL SIGNAL PROCESSING & VLSI DESIGN

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		2	1	1		2	2	3	3		3	3	
CO2			2	1	1		2	2	3	3		3	3	2
CO3	1	2		1	1		2	2	3	3		3	3	1
CO4	1	2		2			2	2	3	3		3	2	
CO5				2			2	2	3	3		3	1	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**PIPELINING AND PARALLEL PROCESSING**	**9**
Introduction, Pipelining of FIR Digital Filters, Parallel Processing. Pipelining and Parallel Processing for Low Power. Retiming: Introduction, Definition and Properties, Solving System of Inequalities, Retiming Techniques.		
Topic - 2	**UNFOLDING AND FOLDING**	**9**
Introduction an Algorithms for Unfolding, Properties of Unfolding, Critical Path, Unfolding and Retiming Application of Unfolding. Folding: Introduction to Folding Transformation, Register Minimization Techniques, Register Minimization in Folded Architectures, Folding in Multirate Systems.		
Topic - 3	**SYSTOLIC ARCHITECTURE DESIGN**	**9**
Introduction, Systolic Array Design Methodology, FIR Systolic Arrays, Selection of Scheduling Vector, Matrix Multiplication and 2D Systolic Array Design, Systolic Design for Space Representations Containing Delays.		
Topic - 4	**FAST CONVOLUTION**	**9**
Introduction, Cook, Toom Algorithm, Winogard Algorithm, Iterated Convolution, Cyclic Convolution, Design of Fast Convolution Algorithm by Inspection.		
Topic - 5	**ITERATION BOUND**	**9**
Data flow graph representations, loop bound and iteration bound, longest path matrix algorithm, iteration bound of Multirate data flow graphs		

THEORY	**45**		**TUTORIAL**			**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Keshab K. Parhi. VLSI Digital Signal Processing Systems, Wiley-Inter Sciences, 1999
2	Mohammed Ismail, Terri, Fiez, Analog VLSI Signal and Information Processing, McGraw Hill, 1994.
3	Kung. S.Y., H.J. While house T.Kailath, VLSI and Modern singal processing, Prentice Hall, 1985.
4	Jose E. France, YannisTsividls, Design of Analog Digital VLSI Circuits for Telecommunications and Signal Processing' Prentice Hall, 1994

OTHER REFERENCES	
1	http://ece.umn.edu/users/parhi/SLIDES/chap2.pdf
2	https://onlinecourses.nptel.ac.in/noc20_ee44/preview
3	https://www.oreilly.com/library/view/vlsi-digital-signal/9780471241867/sec-1.1.html
4	https://books.google.co.in/books?id=APFRHFkMqG8C&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
5	https://www.digimat.in/nptel/courses/video/108105157/L01.html

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. ECE	20ITCE6	CRYPTOGRAPHY AND NETWORK SECURITY	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the basic concepts of network security	K4	1
CO2	Identify the types of symmetric ciphers and its principles	K3	2
CO3	Classify the types of Asymmetric ciphers and its principles	K2	3
CO4	Develop Algorithms for data integration	K6	4
CO5	Explain the privacy issues and Use the procedures in internet security	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3						2	2	3	3		3		
CO2	3	2	3	3			2	2	3	3		3	2	2
CO3	3	2	2	2			2	2	3	3		3	2	
CO4	3	3	3	3			2	2	3	3		3	2	2
CO5	3	3	2			3	2	2	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION**	**9**
Computer security concepts - OSI security architecture - security attacks service mechanism - model for network security – classical encryption techniques – Block cipher principles.		
Topic - 2	**SYMMETRIC CIPHERS**	**9**
Data encryption standard – block cipher operations – cipher block chaining mode – advanced encryption standard – double DES – triple DES – round function – key expansion		
Topic - 3	**ASYMMETRIC CIPHERS AND KEY MANAGEMENT**	**9**
Primary numbers – testing for primality – public key cryptography RSA – distribution of public keys –key management and distribution – public key infrastructure – symmetric key distribution using asymmetric encryption-Block cipher operation-electronic code book		
Topic - 4	**CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS**	**9**
Cryptographic hash functions – application – two simple hash functions – requirements and security hash functions based on cipher block chaining –secure hash algorithm (SHA) – SHA – 3 – message authentication codes-Digital principle and authentication protocols.		
Topic - 5	**NETWORK AND INTERNET SECURITY**	**9**
Transport level security – web security issues – secure socket layer (SSL) – transport layer security (TLS) – HTTPS – Secure shell – pretty good privacy (PGP) – firewalls – IP security-E commerce		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	William Stallings, Cryptography and Network security Principles and Practices, 5th edition, Pearson Education, 2010
2	William Stallings, Network security essentials Ã¢?? application and standards, Prentice Hall of India , 2010
3	Charles P.Fleeger, Shari Lawrence P.Fleeger, Security in computing, Prentice Hall of India, 2009
4	W. Mao, Modern Cryptography Ã¢?? Theory and Practice, Pearson Education, 2007
5	Wade Trappe, Lawrence C Washington, Introduction to Cryptography with coding theory, Pearson Education, 2007

OTHER REFERENCES	
1	https://www.notesforgeeks.in/2021/07/cs8792-cryptography-and-network-security-syllabus-2017-regulation.html
2	https://www.studocu.com/in/document/anna-university/cryptography-and-network-security/cs8792-cryptography-and-network-security/8876690
3	https://cse-r17.blogspot.com/2020/09/cs8792-cryptography-and-network.html
4	https://padeepz.net/cs6701-syllabus-cryptography-and-network-security-regulation-2013-anna-university/
5	https://www.rejinpaul.com/2016/07/cs6701-cryptography-and-network-security-syllabus-notes-question-bank-with-answers.html

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. ECE	20EC6E10	REMOTE SENSING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the foundations of remote sensing	K2	1
CO2	Explain the different types of remote sensing systems and their characteristics in terms of resolutions	K2	2
CO3	Identify the various sensing and imaging techniques	K3	3
CO4	Perform the appropriate satellite image analysis for specific Applications	K3	4
CO5	Classify the types of Radar Sensing System for real time applications	K3	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1						1	3	3		3	2	
CO2	2	1						1	3	3		3	2	1
CO3	3	2	1	1	2	1		1	3	3		3	2	
CO4	3	2	1	1	2	1	1	1	3	3		3	3	1
CO5	3	2	1	1	2	3	2	1	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**CONCEPTS AND FOUNDATIONS OF REMOTE SENSING**	**9**
Introduction, Energy Sources and Radiation Principles, Energy Interactions in the Atmosphere, Physical basis of Signatures of Earth features, Characteristics of Remote Sensing Systems, Global Navigation Satellite Systems(GNSS), An overview of Data Recaption and Data products, Geographic Information Systems(GIS).		
Topic - 2	**EARTH OBSERVATION SYSTEMS (EOS) AND PLATFORMS**	**9**
Introduction, Classification of EOS, 1) Infrared-Visible optical sensors (IVOS): Photographic cameras, Television Cameras, Opto-mechanical Scanners, Push-broom Cameras, Multispectral and Hyper spectral imagers. 2) Microwave EOS: Passive microwave sensors, Active microwave sensors, Synthetic Aperture Radars, Ground Penetrating Radars. 3) Principles of Satellite Motion: Types of orbits, Orbit perturbations, Space craft Elements and GNSS		
Topic - 3	**DATA RECEPTION AND PROCESSING**	**9**
Introduction, Data formats, Data acquisition and onboard data handling, Data reception system, Data pre-processing — Radiometric and Geometric rectifications, Referencing Scheme, Data products generation, Data products Output media, Data Analysis and Quality Assessment, Special processing, digital and visual interpretation.		
Topic - 4	**APPLICATIONS OF EOS IN EARTH RESOURCES MANAGEMENT**	**9**
Agriculture and Soils, Forestry, Geology, Land Cover—Land use Mapping, Water resources, Snow and Glaciers, Urban studies, Coastal zone management and marine fisheries, Desertification, Archaeology.		
Topic - 5	**EOS IMAGE CLASSIFICATION AND SPATIAL DATA MODELLING AND MANAGEMENT**	**9**
Introduction, Supervised and unsupervised classification concepts and methods, Change detection applications, Geographic information systems–Spatial data types, Data preparation and management, GIS working environment, Spatial data infrastructure.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	George Joseph & C. Jeganathan, "Fundamentals of Remote Sensing", 3rdEdition, Universities Press (india) Pvt.Ltd, Hyderabad,2018.
2	Thomas M. Lillesand, Ralph W.Kiefer, "Remote Sensing And Image Interpretation", 7th Edition, JohnWiley, NewDelhi,2015.
3	Campbell, J. B &Randolph H.Wayne, "Introduction to Remote sensing",5thEdition,Guilford Press, USA,2011.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=N49PzLDUIFQ
2	https://www.youtube.com/watch?v=xIsUP1Ds5Pg
3	https://www.youtube.com/watch?v=EYQsXs1Jr0Y
4	https://www.youtube.com/watch?v=u2_My_56hPQ
5	https://www.youtube.com/watch?v=YGOxPPSfduY

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. -ECE	20EC6E7	SATELLITE COMMUNICATION	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Identify and explain the orbital parameters, types of orbit and geo-stationary satellite launching method.	K3	1
CO2	Determine the carrier to noise density ratio, link power budget, system noise in satellite link design	K5	2
CO3	Summarize the equivalent isotropic radiated power, antenna noise, saturation flux density and Inter modulation noise for satellite earth segment	K2	3
CO4	Summarize the equivalent isotropic radiated power, antenna noise, saturation flux density and Inter modulation noise for satellite earth segment	K2	4
CO5	Explain the launching procedures, payloads and functions of Chandrayan-1 and Mangalyaan satellites	K2	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3		1			1	3	3		3	2	2
CO2	3	1	1		1			1	3	3		3	1	2
CO3	3	2	2			1		1	3	3		3	1	1
CO4	2		1		1			1	3	3		3	1	
CO5	2	2	2		2	1		1	3	3		3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**SATELLITE ORBITS**	**9**
Kepler‟s Laws – Newton‟s Law – orbital parameters – orbital perturbation – station keeping – geo stationary and non-Geo-stationary orbits – Antenna Look angle – Limits of visibility – eclipse – Sub satellite point – Sun transit outage – Launching Procedure – Launch Vehicles and propulsion		
Topic - 2	**SPACE SEGMENT AND SATELLITE LINK DESIGN**	**9**
Spacecraft Technology – Structure – Primary power – Attitude Control – Station Keeping – Thermal control – Propulsion Subsystem – Telemetry – Tracking and command (TTC) – Transponders and supporting subsystem – Satellite uplink and downlink Analysis and Design – Link power budget equation – E/N calculation – performance impairments – system noise – inter modulation and interference – Propagation Characteristics and Frequency consideration – System reliability and design lifetime		
Topic - 3	**EARTH SEGMENT**	**9**
Introduction – Receive – Only home TV systems – Outdoor unit – Indoor unit for analog (FM) TV – Master antenna TV System – Community antenna TV System – Transmit – Receive earth stations – Equivalent isotropic radiated power – System noise – Antenna noise – Carrier to Noise ratio – Uplink – Saturation flux density – Input back off – The earth station – HPA – Downlink – Output back off – Satellite TWTA output – Effects of rain – Inter modulation noise.		
Topic - 4	**SATELLITE ACCESS**	**9**
Modulation and Multiplexing: Voice, Data, Video – Analog-digital transmission system – Multiple Access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum Communication		
Topic - 5	**SATELLITE APPLICATIONS**	**9**
INTELSAT Series – INSAT – VSAT – Mobile satellite services: GPS – INMARSAT – Satellite Navigational System – Direct to home Broadcast (DTH) – Worldspace services – Business TV (BTV) – GRAMSAT. Case Studies: Chandrayaan -I – Chandrayaan- II – Mangalyaan (MOM)		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Dennis Roddy, “Satellite Communication”, Mc Graw Hill International, 4th Edition 2016
2	Wilbur L.Pritchard,HendriG.Suyderhoud,Robert A.Nelson, “Satellite Communication Systems Engineering”, Prentice Hall/Pearson, Twelfth Impression 2013.
3	Agarwal, “Design of Geosynchronous Space Craft”, Prentice Hall, 1986
4	David Tse and Pramod Viswanath, Fundamentals of Wireless Communication, Cambridge University Press, 2005
5	Bruce R.Elbert, “The Satellite Communication Application”, Hand Book, Artech House Bostan London, 1997
6	Tri T.Ha, “Digital Satellite Communication”, Mc Graw Hill Education, 2nd Edition 200

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=8D7afGk_OOg
2	https://www.youtube.com/watch?v=Hdc4IQIbmQQ
3	https://www.youtube.com/watch?v=_oDZeKTp99I
4	https://www.youtube.com/watch?v=951kYJpozrk
5	https://www.youtube.com/watch?v=PJvK9kGxUKE

Semester	Programme	Course Code	Course Name	L	T	P	C
VI	B.E. ECE	20ECCE1	DIGITAL IMAGE PROCESSING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Explain the fundamental concepts of a digital image processing.	K2	1
CO2	Compare various Image Transform Techniques.	K3	2
CO3	Apply enhancement and restoration algorithms for image analysis.	K3	3
CO4	Choose appropriate segmentation algorithms for given application.	K4	4
CO5	Compare various Image compression techniques.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2						1	3	3		3	2	
CO2	1		3					1	3	3		3	2	
CO3	2		1			1		1	3	3		3	2	
CO4	1	2	3					1	3	3		3	2	
CO5	1	2	3					1	3	3		3	2	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**DIGITAL IMAGE FUNDAMENTALS**	**9**
Elements of visual perception – Image sensing and acquisition – Image Formation Model, Image Sampling and Quantization, Representation of Digital Images, Spatial and Gray level Resolution, Zooming and Shrinking of Digital Images, Basic relationship between pixels		
Topic - 2	**IMAGE TRANSFORMS**	**9**
1D and 2D image transforms - Separable Transforms - One dimensional Fourier Transform - DFT – Two-dimensional Fourier Transform-Discrete Cosine Transform-Walsh–Hadamard Transform – Wavelet transform –discrete and continuous - Haar transform– Properties.		
Topic - 3	**IMAGE ENHANCEMENT AND RESTORATION**	**9**
Image Enhancement: Spatial Domain Methods. Image subtraction–Image averaging– Spatial filtering - Smoothing, Sharpening filters–First and Second Derivatives–Histogram–Histogram–Equalization Frequency Domain Methods–Filtering-Smoothing and Sharpening–Butterworthfilter Image Restoration: Model of image Degradation / Restoration process.		
Topic - 4	**IMAGE SEGMENTATION AND REPRESENTATION**	**9**
Detection of discontinuities - Point, Line and Edge detection – Gradient operators - Edge linking – Graph theoretic technique – Thresholding – global and adaptive –Region - based segmentation. Boundary representation – chain codes - Polygonal approximation–Signatures–skeletons.		
Topic - 5	**IMAGE COMPRESSION**	**9**
Introduction to image compression – Lossy and Lossless compression–Sequential and Progressive Compression – Rate / Distortion optimization – compression metrics – Huffman c o d i n g–Run Length Coding – Predictive coding – DPCM - T r a n s f o r m c o d i n g – Vector quantization-Image compression standards.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	R.C.Gonzalez,R.E.Woods,"Digital ImageProcessing",Pearson Educationl,4th Edition,2017.
2	AnilK.Jain,"FundamentalsofDigitalImageProcessing"Pearson Education,1st edition, 2015.
3	DavidSalomon,"DataCompression",SpringerVerlagNewYorkInc.,4thEdition،2006.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=Lgdr9WLto4A&list=PL1CE5B4FFFA997E5D
2	https://www.youtube.com/watch?v=FtEShPAFpek&list=PL_mruqjnuVd87sjSDVS9wuit9CSpgIIfx
3	https://www.youtube.com/watch?v=UWQuMnWcmwc
4	https://www.youtube.com/watch?v=W1cTpqM9DaU
5	https://www.youtube.com/watch?v=8kcvyoHsXrw

Semester	Programme	Course Code	Course Name	L	T	P	C
		20ECO01	TELEVISION & VIDEO ENGINEERING	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Compare the Digital TV transmission standards - DVB-T, DVB-S,DVB-C, ATSC, ISDB-T, ISDTV, DTMB and Ultrahigh-definition television.	K2	1
CO2	Compare and contrast the performance of video compression techniques MPEG-1 - MPEG-2 - MPEG-4 and H264.	K3	2
CO3	Explain theprinciples of digital modulation and multiplexing like phase shift modulation techniques, quadrature amplitude modulation and OFDM.	K3	3
CO4	Illustrate the fundamentals of HDTV evolution, transmission and reception of High Definition TV signal.	K4	4
CO5	Explain the working principle of LEDTV, 3DTV, EDTV, IPTV and Smart TV.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1				1	3	3		3	2	
CO2	3	2	3	1				1	3	3		3	2	
CO3	2	2	1	2				1	3	3		3	2	1
CO4	3	1	1	2				1	3	3		3	1	
CO5	1	3	3	1				1	3	3		3	1	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**FUNDAMENTALS OF TELEVISION**	**9**
Aspect ratio-Digital television signal -Digital television standards - DVB-T, DVB-S,DVB-C, ATSC, ISDB-T, ISDTV, DTMB and Ultrahigh-definition television.		
Topic - 2	**AUDIO AND VIDEO CODING**	**9**
Audio and video coding - Source coding- Signal sampling - The quantization process - Video encoding standards - MPEG-1 - MPEG-2 - MPEG-4. Channel coding - Cyclic codes - Convolutional codes - Error correction in digital television standards.		
Topic - 3	**TRANSMISSION SYSTEMS**	**9**
Principles and basics of digital modulation - Phase Shift Modulation Techniques - Quadrature Amplitude Modulation (QAM) - OFDM - Synchronization Systems.		
Topic - 4	**HIGH DEFINITION TV**	**9**
HDTV evolution and role of Grand Alliance – HDTV compressed video and audio streams – Packetized transport – Transmission – HDTV receiver – HDTV standards – Metadata broadcasting		
Topic - 5	**ADVANCED TELEVISION**	**9**
Domestic Broadcast System - Cable TV - Cable Signal Sources- Projection television-Flat panel display TV receivers - LCD and Plasma screen receivers – LEDTV, 3DTV, EDTV, IPTV - Smart TV.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Marcelo S. Alencar, “Digital Television Systems” Cambridge University Press, 2010.
2	Herve Benoit, “Digital Television: Satellite, Cable, Terrestrial, IPTV, MobileTV in the DVB Framework”, Focal Press; 3 edition, 2008.
3	Iain E. G. Richardson, “H.264 and MPEG-4 and Video compression video coding for Next-generation Multimedia”, John Wiley & Sons Ltd., 2003.

OTHER REFERENCES	
1	NPTEL Video https://nptel.ac.in/courses/117102059/,Lecture - 26 TV Transmission, Prof.Surendra Prasad, Department of Electrical Engineering ,IIT Delhi. .
2	NPTEL Video https://nptel.ac.in/courses/117/105/117105131/ Digital TV, Prof.Kalyan Kumar Bandyopadhyay, IIT Kharagpur
3	https://youtu.be/fy0sXbrkMew
4	https://www.youtube.com/watch?v=40eNsj9MGlU
5	https://www.youtube.com/watch?v=27q92epxLqk

Semester	Programme	Course Code	Course Name	L	T	P	C
		20ECO02	SENSORS AND TRANSDUCERS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Compare the Digital TV transmission standards - DVB-T, DVB-S,DVB-C, ATSC, ISDB-T, ISDTV, DTMB and Ultrahigh-definition television.	K2	1
CO2	Compare and contrast the performance of video compression techniques MPEG-1 - MPEG-2 - MPEG-4 and H264.	K3	2
CO3	Explain theprinciples of digital modulation and multiplexing like phase shift modulation techniques, quadrature amplitude modulation and OFDM.	K3	3
CO4	Illustrate the fundamentals of HDTV evolution, transmission and reception of High Definition TV signal.	K4	4
CO5	Explain the working principle of LEDTV, 3DTV, EDTV, IPTV and Smart TV.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1				1	3	3		3	2	
CO2	3	2	3	1				1	3	3		3	2	
CO3	2	2	1	2				1	3	3		3	2	1
CO4	3	1	1	2				1	3	3		3	1	
CO5	1	3	3	1				1	3	3		3	1	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic-1	**INTRODUCTION**	**9**
Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.		
Topic-2	**MOTION, PROXIMITY AND RANGING SENSORS**	**9**
Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).		
Topic-3	**FORCE, MAGNETIC AND HEADING SENSORS**	**9**
Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.		
Topic-4	**OPTICAL, PRESSURE AND TEMPERATURE SENSORS**	**9**
Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.		
Topic-5	**SIGNAL CONDITIONING AND DAQ SYSTEMS**	**9**
Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Patranabis D, “Sensors and Transducers”, 2nd Edition, PHI, New Delhi, 2010.
2	John Turner and Martyn Hill, “Instrumentation for Engineers and Scientists”, Oxford Science Publications, 1999.
3	Richard Zurawski, “Industrial Communication Technology Handbook” 2nd edition, CRC Press, 2015.

OTHER REFERENCES	
1	**https://nptel.ac.in/courses/106/105/106105034/**
2	**https://www.youtube.com/watch?v=6XTYoZymbwE**
3	**https://www.youtube.com/watch?v=MP6VlAE_7WY**

Semester	Programme	Course Code	Course Name	L	T	P	C
		20ECO03	TELECOMMUNICATION SWITCHING SYSTEMS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Design Switching systems for given requirements and configurations	K2	1
CO2	Analyze the processes and performance of a digital telephone switching systems	K3	2
CO3	Perform network synchronization and network management	K2	3
CO4	Analyze various digital subscriber access systems	K3	4
CO5	Apply Traffic theory to understand the characteristics of the telephone systems	K2	5

PRE-REQUISITE	Nil

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3		2		1	3	3		3		
CO2	3	2	2	2				1	3	3		3	2	
CO3	3	1	3	3		2		1	3	3		3		1
CO4	2	2	3	2		2		1	3	3		3		
CO5	2	1	2	2		2		1	3	3		3	3	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**EVOLUTION OF SWITCHING SYSTEMS**	**9**
Brief Outline of manual switching system, trunking, Strowger step by step system, and Crossbar switching Frequency division multiplexing - Time division multiplexing, message switching, circuit switching - packet switching Electronic switching, digital switching, control of switching systems		
Topic - 2	**DIGITAL SWITCHING**	**9**
Switching Functions- Space Division Switching- Time Division Switching- two-dimensional Switching- STS Switching, TST Switching - No.4 ESS Toll Switch- Digital Cross-Connect Systems- Digital Switching in an Analog Environment Elements of SS7 signaling. Timing- Timing Recovery: Phase-Locked Loop, Clock Instability, Jitter Measurements, Systematic Jitter- Timing Inaccuracies- Slips.		
Topic - 3	**NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT**	**9**
ISDN – ISDN Basic Rate Access Architecture, ISDN U Interface, ISDN D Channel Protocol – High Data Rate Digital Subscriber Loops – Asymmetric Digital Subscriber Line, VDSL– Digital Loop Carrier Systems – Universal Digital Loop Carrier Systems, Integrated Digital Loop Carrier Systems, Next Generation Digital Loop Carrier – Fiber in the Loop – Hybrid Fiber Coax Systems – Voice band Modems – Local Microwave Distribution Service – Digital Satellite Services		
Topic - 4	**DIGITAL SUBSCRIBER ACCESS**	**9**
Traffic Characterization – Arrival Distributions, Holding Time Distributions – GoS – Lost–Call Systems – Queuing Systems – Network Blocking Probabilities – End–to–End Blocking Probabilities, Overflow Traffic – Delay Systems– Erlang B system – Exponential service Times, Constant Service Times, Finite Queues, Tandem Queues.		
Topic - 5	**TELECOMMUNICATION TRAFFIC ANALYSIS**	**9**
Integration of Voice and Data-Parameters relating to digitized Voice and Data- History of VoIP - - Benefits and Challenges of VoIP over landline phones- An Integrated TDM Frame-Fixed Boundary Integration-Movable boundary scheme-VoIP Technologies-IP multimedia Systems (IMS)- skype networks.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	J. Bellamy, “Digital Telephony”, 3rd Edition, Wiley student edition, 2011.
2	JE Flood, “Telecommunications Switching, Traffic and Networks”, Pearson Education, 2007
3	Viswanathan. T., “Telecommunication Switching System and Networks”, PHI Ltd., 2006.
4	R.A.Thomson, “Telephone switching Systems”, Artech House Publishers, 2000.
5	W. Stalling, “Data and Computer Communications”, 10th Edition, Pearson, 2013
6	T.N.Saadawi, M.H.Ammar, A.E.Hakeem, “Fundamentals of Telecommunication Networks”, Wiley Interscience, 1994.

OTHER REFERENCES	
1	http://iete–elan.ac.in/SolnQPJun2013/AE64.pd
2	http://www.netlab.tkk.fi/opetus/s38120/k02/LecturesEn/120L2–1e.pdf
3	https://www.youtube.com/watch?v=bPoojxMTh9Y
4	https://www.youtube.com/watch?v=aDGDBjnC7r0

Semester	Programme	Course Code	Course Name	L	T	P	C
		20ECO04	WIRELESS COMMUNICATION	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Assess and select the appropriate multiple accessing methods and propagation path loss model depending on channel model	K2	1
CO2	Apply the innovative ideas in the field of wireless communication, in particular how to communicate effectively and efficiently in wireless cellular communication.	K3	2
CO3	Illustrating the concepts using examples from several modern wireless systems as well as new research developments.	K2	3
CO4	Analyze the mathematical framework for design of wireless systems developed based on suitable equalization and diversity techniques	K4	4
CO5	Apply the innovative ideas to improve the existing technology in the field of digital communication through fading multipath channels and improving capacity in Wireless systems	K3	5

PRE-REQUISITE	Digital Communication

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		2	3				1	3	3		3	1	
CO2	2	1		3			2	1	3	3		3		2
CO3	1		2	2				1	3	3		3	1	
CO4	1	2		2			2	1	3	3		3	1	
CO5	1	3		2		2		1	3	3		3		2

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**PROPAGATION AND MULTIPLE ACCESS TECHNIQUES**	**9**
Fading - Multipath propagation mechanisms - Propagation Models: Free space model, Two ray ground reflection model, Macro cell and Micro cell propagation models. Multiple Access Techniques: FDMA, CDMA, TDMA, SDMA.		
Topic - 2	**CELLULAR MOBILE WIRELESS SYSTEMS**	**9**
Cellular Systems: Structure - Cell Cluster - Frequency reuse - Channel Interference - Cell splitting and sectoring - Channel Assignment schemes: Fixed, Dynamic and Hybrid - Network Architecture - Mobility Management - Location Management - Resource Management: Microcell Concept		
Topic - 3	**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		
Topic - 4	**EQUALIZATION AND DIVERSITY TECHNIQUES**	**9**
Equalisation – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.		
Topic - 5	**MULTIPLE ANTENNA TECHNIQUES**	**9**
MIMO systems – spatial multiplexing -System model -Pre-coding – Beam forming – transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Cory Beard and William Stallings, "Wireless Communication Networks and Systems" Pearson, 2015
2	ITI Saha Misra, "Wireless Communication and Networks: 3G and beyond", McGraw Hil Education Pvt Ltd., Second edition, 2013.
3	K. Daniel Wong, "Fundamentals of Wireless Communication Engineering Technologies" Wiley, 2012
4	David Tse and Pramod Viswanath, Fundamentals of Wireless Communication, Cambridge University Press, 2005
5	T.S.Rappaport, Wireless Communications: Principles and Practice, Second Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint 2003.
6	Mischa Schwartz, "Mobile Wireless Communications", Cambridge University Press, 2005

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=TP8YRb3VH7M
2	https://www.youtube.com/watch?v=wu8kMqvrfSc
3	https://www.youtube.com/watch?v=xFe76sWQf-4
4	https://www.youtube.com/watch?v=gDZSJN9OPcI
5	https://www.youtube.com/watch?v=qKJGRjM9Yck

Semester	Programme	Course Code	Course Name	L	T	P	C
		20EC6T2	VLSI DESIGN	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Develop digital logic circuits and VLSI systems using Verilog Hardware Description Language Programming	K3	1
CO2	Illustrate the components in the logic synthesis-based design flow	K3	2
CO3	Elaborate the characteristics of MOS transistor and techniques used for VLSI fabrication	K2	3
CO4	Make use of layout design rules to draw layout of logic functions and to design circuits using various logic styles	K3	4
CO5	Apply various testing techniques/algorithms to test circuits	K3	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2		1			1	3	3		3	1	3
CO2	3	2	2		1			1	3	3		3	1	3
CO3	3				1			1	3	3		3		2
CO4	3	2	2		1			1	3	3		3	1	3
CO5	3	2						1	3	3		3		1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**VERILOG HDL**	**9 +3**
Data flow Modelling- Behavioural modelling – Structured Procedures- Blocking and non blocking statements- delay control- event control, conditional statements- multiway branching-loops- Switch level modelling - Tasks and Function		
Topic - 2	**LOGIC SYNTHESIS AND RTL DESIGN**	**9 +3**
Logic Synthesis- Impact of Logic Synthesis- Verilog HDL Synthesis- Synthesis Design Flow- Modelling Tips for Logic Synthesis- RTL Design- 4-bit full adder subtractor- ALU Design – Booth Multiplication- GCD Computation.		
Topic - 3	**MOS TRANSISTOR**	**9 +3**
CMOS Logic- MOS Transistor Theory- Long Channel I-V characteristics- C-V characteristics- Nonideal I-V effects DC characteristics-- Power dissipation – Switching Characteristics		
Topic - 4	**MOS FABRICATION**	**9 +3**
An overview of silicon semiconductor technology - Basic CMOS technology: N well- P well, Twin tub and SOI Process- Latch up and prevention- Layout Design rules- Stick diagram- Layout diagram for basic logic gates Introduction to Static CMOS- Pseudo nMOS logic -Dynamic CMOS-Cascade Voltage Switch Logic.		
Topic - 5	**CMOS TESTING**	**9+3**
Introduction to testing- Logic Verification Principles- Test Vectors-Manufacturing test principles- - Fault Models observability, controllability –Fault coverage- DFT-Ad-Hoc Testing- Scan Design- BIST- D-Algorithm and Boolean Difference Method		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Neil Weste & David Harris , "CMOS VLSI Design-A circuits & System Perspective", 4th Edition, Pearson education, New Delhi, 2017.
2	Palnitkar Samir, "Verilog HDL: Guide to Digital Design and synthesis", 2nd Edition, Pearson Education, New Delhi, 2017.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=PJGvZSlsLKs
2	https://www.youtube.com/watch?v=sIDe76QFG2g
3	https://www.youtube.com/watch?v=6OZLl689pi0
4	https://www.youtube.com/watch?v=sV2xT-WCSSI
5	https://www.youtube.com/watch?v=YpbtAwmYCcI

Semester	Programme	Course Code	Course Name	L	T	P	C
		20EC5E2	OPTO ELECTRONICS DEVICES	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Understand the basics of solid state physics.	K2	1
CO2	Design and implement display devices.	K6	2
CO3	Demonstrate and articulate optoelectronic detection devices	K2	3
CO4	Analyze the various optoelectronic modulators.	K4	4
CO5	Determine optoelectronic integrated circuits.	K5	5

PRE-REQUISITE	Electron Devices

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3		2				1	3	3		3		3
CO2	3	2	2	2				1	3	3		3	2	
CO3	3	3	3	2				1	3	3		3		
CO4	2		2					1	3	3		3	2	2
CO5	2	2	3	2				1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**ELEMENTS OF LIGHT AND SOLID STATE PHYSICS**	**9**
Wave nature of light, Polarization, Interference, Diffraction, Light Source, review of Quantum Mechanical concept, Review of Solid State Physics, Review of Semiconductor Physics and Semiconductor Junction Device.		
Topic - 2	**DISPLAY DEVICES AND LASERS**	**9**
Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Numeric Displays, Laser Emission, Absorption, Radiation, Population Inversion, Optical Feedback, Threshold Condition, Laser Modes, Classes of Lasers, Mode Locking, laser applications.		
Topic - 3	**OPTICAL DETECTION DEVICES**	**9**
Photo detector, Thermal detector, Photo Devices, Photo Conductors, Photo diodes, Detector Performance.		
Topic - 4	**OPTOELECTRONIC MODULATOR**	**9**
Introduction, Analog and Digital Modulation, Electro-optic modulators, Magneto Optic Devices, Acoustoptic devices, Optical, Switching and Logic Devices.		
Topic - 5	**OPTOELECTRONIC INTEGRATED CIRCUITS**	**9**
Introduction, hybrid and Monolithic Integration, Application of Opto Electronic Integrated Circuits, Integrated transmitters and Receivers, Guided wave devices.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Pallab Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., New Delhi, 2006.
2	Jasprit Singh, “Opto Electronics – As Introduction to Materials and Devices”, Mc Graw-Hill International Edition, 1998
3	J. Wilson and J.Hawkes, “Opto Electronics – An Introduction”, Prentice Hall, 1995
4	S C Gupta, Opto Electronic Devices and Systems, Prentice Hal of India, 2005.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=J6ES-sW8Eig
2	https://www.youtube.com/watch?v=mtAcrB9JrhA
3	https://www.youtube.com/watch?v=WWjldCmRteg
4	https://www.youtube.com/watch?v=K6ewdRw329s
5	https://www.youtube.com/watch?v=m1gCBJ8jshU

Semester	Programme	Course Code	Course Name	L	T	P	C
		20EC5E5	MEDICAL ELECTRONICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the concepts of Electro-Physiology and Bio-Potential Recording	K4	1
CO2	Demonstrate Bio medical and non electrical parameter measurement	K2	2
CO3	Apply the concepts of Assist Devices in medical treatment	K3	3
CO4	Examine the concepts of Biotelemetry and physical medicine	K4	4
CO5	Describe the recent trends in Medical Instrumentation	K2	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1			2	2	3	3		3	1	
CO2	3	2	3	1			2	2	3	3		3	1	
CO3	2	2	1	2			2	2	3	3		3	1	
CO4	3	1	1	2			2	2	3	3		3	1	
CO5	1	3	3	1			2	2	3	3		3	1	

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course End Survey

COURSE CONTENT		
Topic - 1	**ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING**	**9**
The Origin of Bio-potentials; bio potential electrodes, biological amplifiers, ECG, EEG, EMG, lead systems and recording methods-typical waveform and signal characteristics.		
Topic - 2	**BIO- CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT**	**9**
PH, PO2, PCO2, Electrophoresis, colorimeter, Auto analyzer, Blood flow meter, Cardiac output, respiratory measurement, Blood pressure, Temperature.		
Topic - 3	**ASSIST DEVICES**	**9**
Cardiac pacemakers, DC Defibrillator, Dialyzer, Heart lung machine.		
Topic - 4	**PHYSICAL MEDICINE AND BIOTELEMETRY**	**9**
Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry principles, elements and its advantages, radio-pill		
Topic - 5	**RECENT TRENDS IN MEDICAL INSTRUMENTATION**	**9**
Thermograph, Endoscopy Unit, Lasers in medicine, Electrical safety in medical Equipment Patient monitoring system.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Leislie Cromwell, Bio medical Instrumentation and Measurement,PHI,2007
2	David Prutchi and Michael Norris, Design and Development of Medical Electronic Instrumentation: A Practical perspective of the design construction and test of Medical Device, 2004.
3	RS Khandpur, Hand book of Bio medical Instrumentation, Tata McGraw-Hill,200

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=O0CHWFc-gO8
2	https://youtu.be/QnLRl96fqf4
3	https://www.youtube.com/watch?v=T_iYsVohkz4
4	https://www.youtube.com/watch?v=O8dJ77Xz_IQ
5	https://www.youtube.com/watch?v=-633zoLcHHo

Semester	Programme	Course Code	Course Name	L	T	P	C
		20EC7T3	FIBER OPTIC COMMUNICATIONS	3	1	0	4

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Analyze the behaviour of different optical medium (fibers) and performance of signal Propagation	K4	1
CO2	Analyze the issues in propagation of optical signals resulting from signal degradation mechanism of optical fiber media	K4	2
CO3	Analyze the performance of light sources and apply the concept for choice of light sources for agiven optical link	K4	3
CO4	Apply the concept of working of optical receivers and identify the type of receiver for differentoptical links	K3	4
CO5	Assess the power loss and signal dispersive nature of optical media and apply the result to identifyappropriate transmitter, receiver, on line	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	3			2	2	3	3		3	2	1
CO2	3	2	2	3			2	2	3	3		3	1	2
CO3	3	2	2	1			2	2	3	3		3	2	3
CO4	1	3	2	1			2	2	3	3		3	2	2
CO5	3	2	3	1			2	2	3	3		3	1	1

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Seminar
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**INTRODUCTION TO OPTICAL FIBERS**	**9 +3**
Evolution of fiber optic system- Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations. Mode theory of Circular Waveguides- Overview of Modes-Key Modal concepts- Linearly Polarized Modes Single-Mode Fibers		
Topic - 2	**SIGNAL DEGRADATION OPTICAL FIBERS**	**9 +3**
Attenuation, Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Waveguides-Information Capacity determination. Group Delay-Material Dispersion, Waveguide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers-Mode Coupling, Design Optimization of SM fibers. RI profile and cut-off wavelength.		
Topic - 3	**FIBER OPTICAL SOURCES AND COUPLING**	**9 +3**
Direct and indirect Band gap materials LED structures Light source materials Quantum efficiency and LED power, Modulation of a LED, lasers Diodes Modes and Threshold condition Rate equations External Quantum efficiency Resonant frequencies		
Topic - 4	**FIBER OPTICAL RECEIVERS**	**9 +3**
PIN and APD diodes, Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise Comparison of Photo detectors, Fundamental Receiver Operation, preamplifiers, Error Sources, Receiver Configuration, Probability of Error. Quantum Limit.		
Topic - 5	**DIGITAL TRANSMISSION SYSTEM AND MEASUREMENTS**	**9 +3**
Point to Point links System considerations, Power budget, time budget- bandwidth budget calculations, Noise Effects on System Performance-Principles and operation of WDM, Solitons -EDFA - Basic on concepts of SONET/SDH Network. Principles of OTDR, Attenuation and dispersion, Field Measurements.		

THEORY	**45**		**TUTORIAL**	**15**		**PRACTICAL**	**0**		**TOTAL**	**60**

BOOK REFERENCES	
1	Gerd Keiser, Optical Fiber Communication, McGraw-Hill International, Singapore, 5th edition. 2013
2	J.Gower, Optical Communication System, Prentice Hall of India, 2001. Copy right 2002
3	J.H. Franz, V.K. Jain, Optical Communication-Components and Systems, Narosa Publishing House, 2000
4	J.Senior, Optical Communication, Principles and Practice, Prentice Hall of India, Third edition published 2009.

OTHER REFERENCES	
1	https://www.youtube.com/watch?v=pavBq7HIoIE
2	https://www.youtube.com/watch?v=EreQPmHANmg
3	https://www.youtube.com/watch?v=Pb2CrmCgmkQ
4	https://www.youtube.com/results?search_query=FIBER+OPTICAL+RECEIVERS
5	https://www.youtube.com/watch?v=rOZOa8MHll8

Semester	Programme	Course Code	Course Name	L	T	P	C
		20EC6E3	FUNDAMENTALS OF NANO ELECTRONICS	3	0	0	3

COURSE LEARNING OUTCOMES (COs)			
After Successful completion of the course, the students should be able to		RBT Level	Topics Covered
CO1	Illustrate nano electronics device architectures and interface engineering at atomic level.	K1	1
CO2	Discuss the types of nano-materials and fabrication methods of nanostructures.	K2	2
CO3	Explain electron transport in nanostructures using quantum mechanics theory.	K3	3
CO4	Illustrate nano electronic devices constructed using tunnelling mechanism.	K4	4
CO5	Explain nano MOSFETs with its shrink down approaches and nano devices like Single Electron Transistors, Carbon nano tube transistors, Semiconductor nano wire SETs and FETs-Molecular SETs and molecular electronics-Quantum dot cellular automata.	K5	5

PRE-REQUISITE	NIL

CO / PO MAPPING (1 – Weak, 2 – Medium, 3 – Strong)														
COs	Programme Learning Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2					2	1	3	3		3		
CO2		2	2		2			1	3	3		3	2	
CO3				2			2	1	3	3		3	2	
CO4	2		2		2			1	3	3		3	2	
CO5	2	2			2		2	1	3	3		3		

COURSE ASSESSMENT METHODS		
DIRECT	1	Continuous Assessment Tests
	2	Assignment
	3	End Semester Examinations
INDIRECT	1	Course Exit Survey

COURSE CONTENT		
Topic - 1	**PHYSICS OF NANOELECTRONICS**	**9**
The changing landscape of micro / nano electronics-The region of nanostructures-Beyond CMOS-More than Moore-Classical particles, classical waves-Wave–particle duality, Heisenberg uncertainty principle Electrons behaving as waves (Schrödinger equation)- Scattering and bound states-Atoms to crystals- bands and bonds.		
Topic - 2	**MATERIALS AND FABRICATION OF NANOSTRUCTURES**	**9**
Semiconductors - Semiconductor hetero structures - Lattice-matched hetero structures – Pseudomorphic hetero structures - Organic semiconductors - Carbon nano materials - NanolithographyEtching-Other means for fabrication of nanostructures and nano devices.		
Topic - 3	**ELECTRON TRANSPORT IN NANOSTRUCTURES**	**9**
Time scales of the electrons in solids-length scales of the electrons in solids-Statistics of the electrons in solids and nanostructures: Classical-Statistics of the electrons in solids and nanostructures: Fermi-The density of states of electrons in nanostructures-Classical transport: classical resistance and conductance Quantum ballistic transport: quantum Resistance and conductance-Transport of spin, spintronic devices and applications.		
Topic - 4	**TUNNELING DEVICES**	**9**
Tunnelling through a potential barrier-Potential energy profiles for material interfaces-Metal - insulator, metal – semiconductor-Metal – insulator - metal junctions-Tunnelling diode (TD) and Resonant tunnelling diode (RTD)- Three-terminal resonant tunnelling devices-Technology of RTD-Inverter and logic OR gates based on RTD.		
Topic - 5	**SINGLE ELECTRON AND OTHER NANOELCTRONIC DEVICES**	**9**
Coulomb blockade-Tunnel junction excited by a current source-Performance of the single-electron transistor-SET technology and Field effect transistors-Carbon nano tube transistors (FETs and SETs)-Semiconductor nano wire SETs and FETs-Molecular SETs and molecular electronics-Quantum dot cellular automata.		

THEORY	**45**		**TUTORIAL**	**0**		**PRACTICAL**	**0**		**TOTAL**	**45**

BOOK REFERENCES	
1	Vladimir V. Mitin, Viatcheslav A. Kochelap, Michael A. Stroscio, “Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications”, Cambridge University Press, 2012.
2	George W. Hanson, “Fundamentals of Nanoelectronics”, Prentice Hall, 2007. 3. Karl Goser, Peter GlÖsekötter, Jan Dienstuhl, “Nanoelectronics and Nanosystems”, Springer, 2004.

OTHER REFERENCES	
1	https://nanohub.org/courses/FON2
2	https://www.coursera.org/lecture/nanotechnology/introduction-to-nano-fabrication-tools-7jeWL
3	https://videoportal.uni-freiburg.de/video/Quantum-Transport-in-Nanostructures/157da162206840382181e328a2bb1d4a
4	https://www.youtube.com/watch?v=GJxHvOfwJnQ
5	https://www.youtube.com/watch?v=asEvPyfFhF0