NARAYANA ENGINEERING COLLEGE::NELLORE

AUTONOMOUS

B.Tech – Electronics & Communication Engineering (E.C.E)

Course Structure

&

SYLLABUS

(2020-21 academic year)

(NECR B.Tech 20)

(w.e.f AY: 2020-21)

NARAYANA

ENGINEERING COLLEGE

(AUTONOMOUS)

NARAYANA ENGINEERING COLLEGE::NELLORE

AUTONOMOUS

INSTITUTE VISION & MISSION

VISION

- To be one of the nation's premier Institutions for Technical and Management Education and a key contributor for Technological and Socio-economic Development of the Nation.

MISSION

- To produce technically competent Engineers and Managers by maintaining high academic standards, world class infrastructure and core instructions.
- To enhance innovative skills and multi disciplinary approach of students through well experienced faculty and industry interactions.
- To inculcate global perspective and attitude of students to face real world challenges by developing leadership qualities, lifelong learning abilities and ethical values.

Department of E.C.E –

(Electronics and Communication Engineering)

DEPARTMENT VISION & MISSION

VISION OF THE DEPARTMENT

To produce technically competent and creative engineers who can cater to the industry and societal requirements in the field of Electronics & Communication Engineering.

MISSION OF THE DEPARTMENT

M1. To impart quality engineering education to students to enhance ability to pursue knowledge by providing core competency and state of the art infrastructure.

M2. To provide industry oriented learning for empowering and facilitating the learner through industry institute interaction and leadership qualities.

M3. To promote participation in research and extension activities for addressing the social needs by providing value based education along with life-long learning abilities.

PEOs, POs, PSOs

POs

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

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.

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.

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.

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.

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.

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.

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

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

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.

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.

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.

PEOs

PEO 1: Attain professional excellence or gain higher degree to face challenges posed by industry and society

PEO 2: Address complex problems in a responsive and innovative manner.

PEO 3: Gain reputation by functioning effectively to address social and ethical responsibilities.

PSOs

PSO_1: Domain Specific Knowledge: Implement electronic systems related to Electronics Devices & Circuits, VLSI, Signal processing, Microcomputers, Embedded and Communication Systems to fulfill the solutions to real world challenges

PSO_2: Hardware Product Development: Apply the software and hardware tools in Analog and Digital Electronic circuit design to address complex Electronics and Communication engineering problems.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Course Structure for B.Tech ECE w.e. f AY: 2020-21

SEMESTER I

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20MA1001	BS	Algebra and Calculus	3	1	0	4	4	40	60	100
20PH1001	BS	Applied Physics	3	0	0	3	3	40	60	100
20ES1001	ES	Problem Solving and Programming	3	0	0	3	3	40	60	100
20EN1001	HS	English	2	0	0	2	2	40	60	100
20PH1501	BS	Applied Physics Lab	0	0	3	3	1.5	40	60	100
20EN1501	HS	English Language Lab	0	0	3	3	1.5	40	60	100
20ES1502	ES	Electronics and Communication Engineering Workshop	0	0	2	2	1	40	60	100
20ES1505	ES	Engineering and IT Workshop	0	0	4	4	2	40	60	100
20ES1506	ES	Problem Solving and Programming Lab	0	0	3	3	1.5	40	60	100
20MC8001	MC	Mandatory course I	Induction Program							
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester					20 Points		
		Total	11	1	18	30	19.5	360	540	900

SEMESTER II

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20CH1001	**BS**	Chemistry	3	0	0	3	3	40	60	100
20MA1004	**BS**	Vector Calculus and Transforms	3	1	0	4	4	40	60	100
20ES1004	**ES**	Basic Electrical Engineering	3	0	0	3	3	40	60	100
20ES1007	**ES**	Introduction to Python Programming	2	0	0	2	2	40	60	100
20CH1501	**BS**	Chemistry Lab	0	0	3	3	1.5	40	60	100
20ES1509	**ES**	Basic Electrical Engineering Lab	0	0	2	2	1	40	60	100
20ES1504	**ES**	Engineering Graphics Lab	0	1	4	5	3	40	60	100
20ES1510	**ES**	Introduction to Python Programming Lab	0	0	2	2	1	40	60	100
20EN1502	**HS**	Oral Communication Skills Lab	0	0	2	2	1	40	60	100
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester					20 Points		
		Total	**11**	**2**	**16**	**29**	**19.5**	**360**	**540**	**900**

SEMESTER III

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
20MA1005	BS	Complex Analysis and Numerical Methods	3	0	0	3	3	40	60	100
20ES1011	ES	Data Structures	2	0	2	4	3	40	60	100
20ES1013	ES	Electronic Devices and Circuits	3	0	0	3	3	40	60	100
20EC2001	PC	Digital Logic Design	3	0	0	3	3	40	60	100
20EC2002	PC	Network Theory	3	0	0	3	3	40	60	100
20ES1516	ES	Electronic Devices and Circuits Lab	0	0	3	3	1.5	40	60	100
20EC2501	PC	Digital Logic Design Lab	0	0	3	3	1.5	40	60	100
20EC2502	PC	Network Theory Lab	0	0	3	3	1.5	40	60	100
20CD6001	SC	Career Competency Development I	0	0	2	2	1	40	60	100
20CC6001	SC	Value Added Course/ Certificate Course I	0	0	0	0	1	40	60	100
20MC8002-12	MC	Mandatory Course II	2	0	0	2	0	00	00	00
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester					20 Points		
		Total	**16**	**0**	**16**	**32**	**21.5**	**400**	**600**	**1000**

SEMESTER IV

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
20EC2003	PC	Analog Electronics	3	0	0	3	3	40	60	100
20EC2004	PC	Control Systems	2	0	0	2	2	40	60	100
20EC2005	PC	Electromagnetic Theory and Transmission Lines	3	0	0	3	3	40	60	100
20EC2006	PC	Probability and Random Processes	3	0	0	3	3	40	60	100
20EC2007	PC	Signals and Systems	3	0	0	3	3	40	60	100
-	OE	Open Elective I	3	0	0	3	3	40	60	100
20EC2503	PC	Analog Electronics Lab	0	0	3	3	1.5	40	60	100
20EC2504	PC	MATLAB and Simulink Lab	0	0	2	2	1	40	60	100
20CD6002	SC	Career Competency Development II	0	0	2	2	1	40	60	100
20CC6002	SC	Value Added Course/ Certificate Course II	0	0	0	0	1	40	60	100
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester					20 Points		
		Total	**17**	**0**	**10**	**27**	**21.5**	**400**	**600**	**1000**

SEMESTER V

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
20EC2008	PC	Analog and Digital Communications	3	0	0	3	3	40	60	100
20EC2009	PC	Linear IC Applications	3	0	0	3	3	40	60	100
20EC2010	PC	Microprocessors and Microcontrollers	3	0	0	3	3	40	60	100
-	OE	Open elective II	3	0	0	3	3	40	60	100
20EC4001-06	PE	Professional Elective I	3	0	0	3	3	40	60	100
20EC2505	PC	Analog and Digital Communications Lab	0	0	3	3	1.5	40	60	100
20EC2506	PC	Microprocessors and Microcontrollers Lab	0	0	3	3	1.5	40	60	100
20CD6003	SC	Career Competency Development III	0	0	2	2	1	40	60	100
20CC6003	SC	Value Added Course/ Certificate Course III	0	0	0	0	1	40	60	100
20EC7501	PR	Internship I/on job training/Com Ser Project	0	0	0	0	1.5	00	100	100
20MC8002-12	MC	Mandatory Course III	2	0	0	2	0	00	00	00
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester					20 Points		
		Total	**17**	**0**	**10**	**28**	**21.5**	**360**	**640**	**1000**

SEMESTER VI

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
20EC2011	PC	Digital Design using HDL	3	0	0	3	3	40	60	100
20EC2012	PC	Digital Signal Processing	3	0	0	3	3	40	60	100
-	OE	Open Elective III	3	0	0	3	3	40	60	100
20EC4007-12	PE	Professional Elective II	3	0	0	3	3	40	60	100
20EC4013-18	PE	Professional Elective III	3	0	0	3	3	40	60	100
20EC2507	PC	Digital Signal Processing Lab	0	0	3	3	1.5	40	60	100
20EC2508	PC	Integrated Circuits Lab	0	0	3	3	1.5	40	60	100
20EC2509	PC	Electronic Design Workshop	0	0	3	3	1.5	40	60	100
20CD6004	SC	Career Competency Development IV	0	0	2	2	1	40	60	100
20CC6004	SC	Value Added Course/ Certificate Course IV	0	0	0	0	1	40	60	100
		Counselling/ Mentoring	0	0	1	1	0	--	--	--
		Sports/ Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester						20 Points	
		Total	**15**	**0**	**12**	**29**	**21.5**	**400**	**600**	**1000**

SEMESTER VII

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
20HS5001 -8	HS	Humanities and Social Science Elective	2	0	0	2	2	40	60	100
20EC2013	PC	VLSI Design	3	0	0	3	3	40	60	100
20EC2014	PC	Microwave and Optical Communications	3	0	0	3	3	40	60	100
-	OE	Open Elective IV	3	0	0	3	3	40	60	100
20EC4019-24	PE	Professional Elective IV	3	0	0	3	3	40	60	100
20EC4025-30	PE	Professional Elective V	3	0	0	3	3	40	60	100
20EC2510	PC	VLSI Design Lab	0	0	2	2	1	40	60	100
20EC2511	PC	Microwave and Optical Communications Lab	0	0	3	3	1.5	40	60	100
20CD6005	SC	Career Competency Development V	0	0	2	2	1	40	60	100
20CC6501	SC	Skill Development Training	0	0	2	2	1	40	60	100
20EC7502	PR	Internship II/on job training/Com Ser Project	0	0	0	0	1.5	00	100	100
20MC8002-12	MC	Mandatory Course IV	2	0	0	2	0	00	00	00
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester						20 Points	
		Total	**19**	**0**	**12**	**31**	**23**	**400**	**700**	**1100**

SEMESTER VIII

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total Marks
20EC7503	PR	Project work, seminar and internship	0	0	0	0	12	60	140	200
		Activity Point Programme	During the Semester					20 points		
			0	**0**	**0**	**0**	**12**	**60**	**140**	**200**

Open Electives (OE) offered by ECE Department

S. No	Course Code	Subject
1	20EC3001	Image Processing
2	20EC3002	Embedded Systems
3	20EC3003	Nano Technology
4	20EC3004	VLSI Design
5	20EC3005	Sensors and Actuators
6	20EC3006	Internet of Things (IoT)
7	20EC3007	Microprocessors and Microcontrollers
8	20EC3008	Wireless Sensor Networks
9	20EC3009	Microprocessor and Interfacing
10	20EC3010	Data Communication and Networks
11	20EC3011	Digital Logic Design
12	20EC3012	Principles of Communication

PROFESSIONAL ELECTIVE (PE)

The Professional Elective Courses (PE) are shown in different tracks/groups: The students will have options of selecting the electives from the different tracks/groups depending on the specialization one wishes to acquire.

~~ELECTIVE~~ TRACK/GROUP	Professional Elective-1	Professional Elective-2	Professional Elective-3	Professional Elective-4	Professional Elective-5
Communications	An Introduction to coding theory (20EC4001)	Antennas (20EC407)	Satellite communication (20EC4013)	Wireless communication (20EC4019)	Signal Processing for mm Wave Communication for 5G and Beyond (20EC4025)
Micro Electronics	Industrial Electronics (20EC4002)	Micro Electronics (20EC4008)	Introduction to MEMS (20EC4014)	Fundamentals of Nano and Quantum Photonics (20EC4020)	High Speed Electronics (20EC4026)
Signal & Image Processing	MATLAB Programming For Numerical Computation (20EC4003)	Adaptive Signal Processing (20EC4009)	Introduction to Machine Learning (20EC4015)	Digital Image Processing (20EC4021)	Digital Speech Processing (20EC4027)
VLSI	Fundamentals of Micro and Nano Fabrication (20EC4004)	Mixed Signal Design (20EC4010)	RF Integrated Circuits (20EC4016)	Low Power VLSI Design (20EC4022)	FPGA Architectures (20EC4028)
Embedded System	Semiconductor Memories (20EC4005)	Real Time Operating Systems (20EC4011)	Introduction to Internet of things (20EC4017)	Advanced Embedded Logic design (20EC4023)	Embedded System Design with ARM (20EC4029)
Automation	Programmable Logic Controllers (20EC4006)	Electronic Measurements & Instrumentation (20EC4012)	Biomedical Instrumentation (20EC4018)	Virtual Instrumentation (20EC4024)	Process Control & Instrumentation (20EC4030)

HONORS

S. NO.	COURSE NAME	COURSE CODE	CREDITS
	POOL 1		
1	CMOS IC Design	20ECH001	4
2	CAD for VLSI	20ECH002	4
3	VLSI Testing	20ECH003	4
4	ASIC Design	20ECH004	4
	POOL 2		
1	Spread Spectrum Communications	20ECH005	4
2	Modern Digital Communication Techniques	20ECH006	4
3	Cellular and Mobile Communications	20ECH007	4
4	Radar Systems	20ECH008	4
	POOL 3		
1	Multimedia Compression Techniques	20ECH009	4
2	Digital Video Processing	20ECH010	4
3	Advanced Digital Signal Processing	20ECH011	4
4	DSP Algorithms and Architectures	20ECH012	4
	POOL 4		
1	Advanced Microcontroller	20ECH013	4
2	ARM Based Development	20ECH014	4
3	Embedded Computing	20ECH015	4
4	Embedded Software Testing	20ECH016	4

MINORS

S. NO	SUBJECT	COURSE CODE	CREDITS
1	Network Analysis	20ECM001	4
2	Electronic Devices Circuits	20ECM002	4
3	Signals and Systems	20ECM003	4
4	Information Theory and Coding	20ECM004	4
5	Electronic Circuit Analysis	20ECM005	4
6	Microprocessors	20ECM006	4
7	Integrated Circuits	20ECM007	4
8	Digital Signal Processing	20ECM008	4

HUMANITIES AND SOCIAL SCIENCES (HS)

SEMESTER	SUBJECT	COURSE CODE	CREDITS
I	English	20EN1001	2
	English Language Lab	20EN1501	1.5
II	Oral Communication Skills Lab	20EN1502	1
VII	Humanities and Social Science Elective	20HS5008	2
	TOTAL		**6.5**

BASIC SCIENCES (BS)

SEMESTER	SUBJECT	COURSE CODE	CREDITS
I	Applied Physics	20PH1001	3
	Algebra and Calculus	20MA1001	4
	Applied Physics Lab	20PH1501	1.5
II	Vector Calculus and Transforms	20MA1004	4
	Chemistry	20CH1001	3
	Chemistry Lab	20CH1501	1.5
III	Complex Analysis and Numerical Methods	20MA1005	3
		TOTAL	**20**

ENGINEERING SCIENCES (ES)

SEMESTER	SUBJECT	COURSE CODE	CREDITS
I	Problem Solving and Programming	20ES1001	3
	Engineering and IT Workshop	20ES1505	2
	Problem Solving and Programming Lab	20ES1506	1.5
	Electronics and Communication Engineering Workshop	20ES1502	1
II	Basic Electrical Engineering	20ES1004	3
	Introduction to Python Programming	20ES1007	2
	Introduction to Python Programming Lab	20ES1510	1
	Engineering Graphics lab	20ES1504	3
	Basic Electrical Engineering Lab	20ES1509	1
III	Data Structures	20ES1011	3
	Electronic Devices and Circuits	20ES1013	3
	Electronic Devices and Circuits Lab	20ES1516	1.5
		TOTAL	**25**

PROFESSIONAL CORE (PC)

SEMESTER	COURSE CODE	SUBJECT			CREDITS
III	20EC2001	Digital Logic Design			3
	20EC2002	Network Theory			3
	20EC2501	Digital Logic Design Lab			1.5
	20EC2502	Network Theory Lab	(2+2)	9	1.5
IV	20EC2007	Analog Electronics			3
	20EC2003	Electromagnetic Theory and Transmission Lines			3
	20EC2004	Control System			2
	20EC2005	Probability and Random Processes			3
	20EC2006	Signals and Systems			3
	20EC2503	Analog Electronics Lab			1
	20EC2504	MATLAB and Simulink Lab	(5+2)	16.5	1.5
V	20EC2008	Analog and Digital Communications			3
	20EC2009	Linear IC Applications			3
	20EC2010	Microprocessors and Microcontrollers			3
	20EC2505	Analog and Digital Communications Lab			1.5
	20EC2506	Microprocessors and Microcontrollers Lab	(3+2)	12	1.5
VI	20EC2011	Digital Design using HDL			3
	20EC2012	Digital Signal Processing			3
	20EC2507	Digital Signal Processing Lab			1.5
	20EC2508	Integrated Circuits Lab			1.5
	20EC2509	VLSI Design Lab	(3+3)	10.5	1.5
VII	20EC2013	VLSI Design			3
	20EC2014	Microwave and Optical Communications			3
	20EC2510	Electronic Design Workshop			1.5
	20EC2511	Microwave and Optical Communications Lab	(1+2)	8.5	1
		TOTAL			56.5

PROFESSIONAL ELECTIVES (PE)

SEMESTER	SUBJECT	COURSE CODE	CREDITS
V Sem	Professional Elective I	20EC4001-06	3
VI Sem	Professional Elective II	20EC4007-12	3
	Professional Elective III	20EC4013-18	3
VII Sem	Professional Elective IV	20EC4019-24	3
	Professional Elective V	20EC4025-30	3
	TOTAL		**15**

OPEN ELECTIVES (OE)

SEMESTER	SUBJECT	CREDITS
IVSem	Open Elective I	3
V Sem	Open Elective II	3
VI Sem	Open Elective III	3
VIISem	Open Elective IV	3
	TOTAL	**12**

SKILL ORIENTED COURSE (SC)

SEMESTER	SUBJECT	COURSE CODE	CREDITS
III Sem	Career Competency Development I	20CD6001	1
	Value Added Course/Certificate Course I	20CC6001	1
IV Sem	Career Competency Development II	20CD6002	1
	Value Added Course/Certificate Course II	20CC6002	1
V Sem	Career Competency Development III	20CD6003	1
	Value Added Course/Certificate Course III	20CC6003	1
VI Sem	Career Competency Development IV	20CD6004	1
	Value Added Course/Certificate Course IV	20CC6004	1
VII Sem	Career Competency Development V	20CD6005	1
	Skill Development Training	20CC6501	1
		TOTAL	**10**

PROJECT (PR)

SEMESTER	SUBJECT	COURSE CODE	CREDITS
V Sem	Internship I/on job training/Com Ser Project	20EC7501	1.5
VII Sem	Internship II/on job training/Com Ser Project	20EC7502	1.5
VIII Sem	Project work, seminar and internship	20EC7503	12
		TOTAL	**15**

S. NO	CAT	CREDITS PER SEMESTER								CREDITS	AICTE
		I	II	III	IV	V	VI	VII	VIII		
1	**HS**	3.5	1					2		**6.5**	**12**
2	**BS**	8.5	8.5	3						**20**	**25**
3	**ES**	7.5	10	7.5						**25**	**24**
4	**PC**			9	16.5	12	10.5	8.5		**56.5**	**48**
5	**OE**				3	3	3	3		**12**	**18**
6	**PE**					3	6	6		**15**	**18**
7	**PR**					1.5		1.5	12	**15**	**15**
8	**SC**			2	2	2	2	2		**10**	**--**
	MC	**No Credits**									**NC**
	TOTAL	**19.5**	**19.5**	**21.5**	**21.5**	**21.5**	**21.5**	**23**	**12**	**160**	**160**

NARAYANA ENGINEERING COLLEGE::NELLORE

AUTONOMOUS

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER I

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20MA1001	**BS**	Algebra and Calculus	**3**	**1**	**0**	**4**	**4**	**40**	**60**	**100**
20PH1001	**BS**	Applied Physics	**3**	**0**	**0**	**3**	**3**	**40**	**60**	**100**
20ES1001	**ES**	Problem Solving and Programming	**3**	**0**	**0**	**3**	**3**	**40**	**60**	**100**
20EN1001	**HS**	English	**2**	**0**	**0**	**2**	**2**	**40**	**60**	**100**
20PH1501	**BS**	Applied Physics Lab	0	0	3	3	1.5	40	60	100
20EN1501	**HS**	English Language Lab	0	0	3	3	1.5	40	60	100
20ES1502	**ES**	Electronics and Communication Engineering Workshop	0	0	2	2	1	40	60	100
20ES1505	**ES**	Engineering and IT Workshop	0	0	4	4	2	40	60	100
20ES1506	**ES**	Problem Solving and Programming Lab	0	0	3	3	1.5	40	60	100
20MC8001	**MC**	Mandatory course I	Induction Program							
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester					20 Points		
		Total	**11**	**1**	**18**	**30**	**19.5**	**360**	**540**	**900**

NARAYANA ENGINEERING COLLEGE::NELLORE

AUTONOMOUS

NARAYANA ENGINEERING COLLEGE:: NELLORE								
20MA1001	ALGEBRA &CALCULUS (CSE, ECE, EEE, CE, ME)							R-2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	1	0	64	4	40	60	100

Pre-requisite: Intermediate Mathematics

Course Objectives:

1. To familiarize the students with the theory of matrices and quadratic forms
2. To analyze first order ordinary differential equations.
3. To enlighten the learners in the concepts of higher order differential equation an its applications
4. To explain the series expansions using mean value theorems and the concepts of multivariable differential calculus.
5. To summarize the procedure to solve the partial differential equations.
6. To explain the student with mathematical tools needed in evaluating multiple integrals and its applications.

Course Outcomes: After successful completion of the course, the student will be able to	**Blooms taxonomy Level**
CO 1	Make use the concepts of Matrices to solve various Engineering problems .(BL-3)
CO 2	Solve the First order differential equations arising in various engineering fields .(BL-3)
CO 3	Identify different types of higher order differential equations and their applications in solving engineering problems . (BL-3)
CO 4	Apply Mean value theorems, Multi variable calculus to solve engineering problems.(BL-3)
CO 5	Identify solution methods for partial differential equations that model physical processes (BL-3)
CO 6	Apply multiple integrals techniques to solve engineering problems.(BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3											1	
CO2	3	3											1	
CO3	3	3											1	
CO4	3	3											1	
CO5	3	3											1	
CO6	3	3											1	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	MATRICES	14 h

Introduction to matrices, Definition of Rank ,Definition of Echelon form , Problems, Solving System of Non-Homogeneous equations- Definition, Conditions for Consistency, Problems, Solving System of Homogeneous equations- Definition, Problems, Eigen values & Eigen Vectors- Definition, Problems ,properties of Eigen values & Eigen Vectors(Without proof), Cayley – Hamilton Theorem -

Statement(Without proof),finding inverse and power of a matrix by Cayley-Hamilton Theorem, Diagonalization of a Matrix-Definition, similarity of a matrix ,modal matrix, spectral matrix,powers of a matrix, problems on Diagonalization of a matrix, Quadratic Forms- Definition, Finding Matrix from Q.F, Index, signature, rank and nature of the quadratic forms, Reduction of Q.F. into a canonical form by linear transformation , Reduction of Q.F. into a canonical form by orthogonal transformation.

At the end of the Module 1, students will be able to:

1. Solve the system of homogenous and non-homogenous linear equations.(BL-3)
2. Obtain the Eigen values and Eigen vectors of a matrix.(BL-2)
3. Identify special properties of matrix and for using this information to study the nature of the linear equations. (BL-3)
4. Find the inverse and powers of a square matrix.(BL-1)
5. Obtain the diagonalization form of the matrix.(BL-2)
6. Apply the techniques of matrices in various engineering problems. (BL-3)

MODULE -2	**FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS**	**9h**

Exact Differential equation - Definition, condition for exactness, problems, Non - Exact Differential equations- Integrating factor , Method1:Integrating factor by inspection, problems, Method2:Finding Integrating factor , problems, Method3:Finding Integrating factor , problems, Method4:Finding Integrating factor , problems, Method5:Finding Integrating factor , problems, Linear differential Equation- Definition,Working rule to find general solution, problems, Bernoulli's differential Equation-Definition, Working rule to find general solution, problems, Applications of Differential equation of First order: Newton's law of Cooling-Explanation of the concept, problems, Law of natural growth and Decay- Explanation of the concept, problems and Simple Electric Circuits-Explanation of the concept, problems.

At the end of the Module 2, students will be able to:

1. Identify the first order ordinary differential equations. (BL-3)
2. Solve the first order ordinary differential equations. (BL-3)
3. Apply the techniques of first order ordinary differential equations in Newton's law of cooling, Natural growth& Decay problems. (BL-3)
4. Make Use of the first order ordinary differential equation techniques in simple electric circuits.(BL-3)

MODULE-3	**HIGHER ORDER ORDINARY DIFFERENTIAL EQUATIONS**	**10h**

Non-Homogenous Linear Differential equation of second and higher order with constant coefficients-Definition, complete solution, operator D, rules for finding Complimentary function, problems, inverse operator, General method for finding Particular Integral**.**

Non-homogeneous Linear Differential Equations of Second & Higher order with Constant coefficients with RHS term of the typee^{ax},sinax ,cosax, Polynomial in X,$e^{ax}v(x)$, X.V(x)-Explanation of the concept& problems, Method of variation of parameters- Explanation of the concept& problems, Euler-Cauchy equation- Definition, problems ,Legendre's Linear equation- Definition, problems. Applications to Higher order Differential Equations - L-C-R circuits, problems.

At the end of the Module 3, students will be able to:

1. Identify the higher order ordinary differential equations. (BL-3)
2. Solve the linear differential equations with constant coefficients by appropriate methods. (BL-3)
3. Solve the linear differential equations with variable coefficients by appropriate methods.(BL-3)
4. Make Use of the higher order ordinary differential equations techniques in electrical circuits. and in various engineering problems. (BL-3)

MODULE-4	MEAN VALUE THEOREMS & MULTIVARIABLE CALCULUS	9h

Taylor's and Maclaurin's theorems with remainders-Statements (without proof), problems on Taylor's series , problems on Maclaurin's series, Jacobean-Definition, Properties , problems ,Functional dependence-Definition , problems ,Maxima & Minima of function of two variables - Rules , Maxima & Minima of function of two variables without constraint- problems ,Maxima & Minima of function of two variables with constraint- problems, Lagrange's Method of Undetermined multipliers, problems.

At the end of the Module 4, students will be able to:

1. Demonstrate the given function as a series of Taylor's and maclurin's with remainders.(BL-2)
2. Illustrate series expansions of functions using mean value theorems. (BL-2)
3. Apply Jacobean concept to deal with problems in change of variables.(BL-3)
4. Obtain the maxima and minimum values of the function for two variables.(BL-2)
5. Apply the mean value theorems to check the continuity of the function in the given interval. (BL-3)

MODULE-5	PARTIAL DIFFERENTIAL EQUATIONS	11h

Definition ,Formation of PDE by the Method of Elimination of arbitrary constants, problems ,Method of Elimination of arbitrary functions, problems, Method of Separation of Variables-Explanation of the concept& problems, First order linear partial differential equations-Definition, Solutions of first order linear PDE-Working rule of Lagrange's Method, problems ,First order non-linear partial differential equations- Definition, Solutions of first order non-linear partial differential equations-Standard form-I, problems , Standard form-II, problems ,Standard form-III, problems, Standard form-IV, problems.

At the end of the Module 5, students will be able to:

1. Identify the basic properties of partial differential equations. (BL-3)
2. Outline partial differential equations. (BL-2)
3. Solve the applications of PDE by using the method of separation of variables (BL-3)
4. Apply the PDE techniques in various engineering fields. (BL-3)

MODULE-6	MULTIPLE INTEGRALS	11h

Double Integrals- Introduction, Evaluation in Cartesian coordinates, problems, Evaluation in Polar coordinates, change of variables – Problems on Cartesian to Polar, Change of Order of Integration-Problems , Area enclosed by plane curves - Problems, Triple integrals- Introduction, Evaluation of Triple Integrals, Volume by Triple Integrals – Problems, Change of variables between Cartesian, cylindrical and spherical polar coordinates- Problems.

At the end of the Module 6, students will be able to:

1. Obtain double integrals in Cartesian and polar co-ordinates. (BTL-2)
2. Obtain the area bounded by a region using double integration techniques.(BTL-2)
3. Solve triple integrals.(BTL-3)
4. Obtain volumes by using triple integrals.(BTL-2)
4. Make Use of multiple integral techniques in engineering problems.(BTL-3)

Total hours:	**64 hours**

Content beyond syllabus:

1. Orthogonal Trajectories.
2. Deflection of Beams.
3. Simultaneous Linear equations with constant coefficients
4. Taylor's series for function of two variables.
5. HomogeneousLinear Partial differential equations with constant coefficients.
6. Calculation of mass, centreof gravity, moment of inertia

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	**Matrices**	CO1	**https://youtu.be/P2pL5VThrzQ**
2	**First Order Ordinary Differential Equations**	CO2	**https://youtu.be/P7gVp333B6M**
3	**Higher Order Ordinary Differential Equations**	CO3	**https://youtu.be/btOCUmJkrrg**
4	**Mean value theorems & Multivariable Calculus:**	CO4	**https://youtu.be/bJPuy0QZ-tE** **https://youtu.be/0apMXhWG_W8** **https://youtu.be/aqfSOOiO2kI**
5	**Partial DifferentialEquations**	CO5	https://youtu.be/kZ7Oa7iMiCs
6	**Multiple Integrals**	CO6	https://youtu.be/mIeeVrv447s

Text Book(s):

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017
3. N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

Reference Book(s):

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.
3. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education
4. H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.

NARAYANA ENGINEERING COLLEGE :: NELLORE								
20PH1001	APPLIED PHYSICS							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	48	3	40	60	100

Pre-requisite: Fundamental concepts of Physics

Course Objectives:

1. To identify the importance of the optical phenomenon i.e. interference and diffraction related to its Engineering applications
2. To enable the students in understanding the importance of quantum physics
3. To learn the dynamics of free electrons in metals by applying Free electron theories on metals.
4. To explain and provide the knowledge about semiconductors
5. To teach the concepts related to superconductivity & nanomaterials which leads to their fascinating applications.
6. To impart knowledge in basic concepts of LASERs along with its Engineering applications.

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

CO 1	Comprehend the concepts of matter waves, wave functions and its interpretation to understand the matter at atomic scale. (BL-2)
CO 2	Outline Free electron theories on metals (BL-2)
CO 3	Demonstrate the physics of semiconductors. (BL-2)
CO 4	Illustrate the concepts of super conducting materials and nano-materials for scientific and engineering applications. (BL-2)
CO 5	Realize importance of LASERs and optical fibers in Engineering and Medical applications. (BL-2)
CO 6	Comprehend the concepts of matter waves, wave functions and its interpretation to understand the matter at atomic scale. (BL-2)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2												
CO2	3	2												
CO3	3	1												
CO4	3	1												
CO5	3	2				1							1	
CO6	3	1				1							1	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	WAVE OPTICS	9h

Interference-Principle of Superposition, Interference of light, Conditions for sustained Interference ,derivation of conditions for constructive and destructive interference of reflected light from a thin film, Newton's Rings-experimental arrangement, Determination of Wavelength; Engineering applications of Interference

Diffraction-distinction between interference and diffraction, differences between Fresnel &Fraunhoffer diffractions, Fraunhoffer Diffraction at single slit(derivation, energy distribution

curve) , Fraunhoffer Diffraction at a Double slit (derivation, energy distribution curve),Theory of Diffraction Grating -Determination of Wavelength; Engineering applications of diffraction

At the end of the Module 1, students will be able to:

1. explain the need of coherent sources and the conditions for sustained interference (BL2)
2. describe the theory of interference of reflected light from a thin film (BL2)
3. explain the theory of Fraunhoffer Diffraction of light at single and multiple slits (BL2)
4. identify engineering applications of interference and diffraction (BL3)
5. analyze the differences between interference and diffraction (BL4)

MODULE -2	**INTRODUCTION TOQUANTUMMECHANICS**	**8h**

Matter waves -de-Broglie hypothesis - properties, G.P.Thomson experiment, Phase and group velocities—Expression for group velocity; Heisenberg's uncertainty principle; Schrodinger's time dependent and independent wave equations – Physical significance of wave function-important characteristics of wave function, free particle energy, wave function, momentum; operators and expectation values, Eigen values and Eigen functions of a particle confined to one dimensional infinite square well (potentialwell).

At the end of the Module 2, students will be able to:

1. understand the concept of matter waves (BL2)
2. Recognize the difference between phase velocity and group velocity (BL2).
3. understand Physical significance of wave function (BL2)
4. Identify the importance of Schrodinger's wave equation in describing the motion of Elementary particles (BL3) **.**

MODULE-3	**FREE ELECTRON THEORY OF METALS**	**8 h**

Classical free electron theory-assumptions, expression for electrical conductivity, merits and demerits; Quantum free electron theory of metals-expression for electrical conductivity; Fermi-Dirac distribution, Mathiesson rule, causes of electrical resistance in metals, Bloch's theorem (Qualitative), Kronig - Penny Model (Qualitative), effective mass and Brillouin zones, Classification of solids into conductors, semiconductors and insulators based on energy band gap.

At the end of the Module 3, students will be able to:

1. Explain classical, Quantum free electron theory of metals (BL2).
2. Apply these theories to explain electrical conductivity in metals (BL3)
3. Explain formation of energy bands in solids(BL2) .
4. Understand the band structure of a solid and Classify materials as metals, insulators, or semiconductors, and sketch a schematic band diagram for each one (BL2).

MODULE-4	**INTRODUCTION TO SEMICONDUCTORS**	**8 h**

Origin of energy bands , Intrinsic semiconductors - density of charge carriers(derivation),Fermi energy , Electrical conductivity; extrinsic semiconductors - P-type & N-type , Density of charge carriers , Dependence of Fermi energy on carrier concentration and temperature; Direct and Indirect band gap semiconductors, Hall effect- Hall coefficient (derivation), Applications of Hall effect ; Drift and Diffusion currents , Einstein coefficients, Continuity equation(derivation) ,Applications ofSemiconductors.

At the end of the Module 4, students will be able to:

1. Outlinethe properties of n-type and p-type semiconductors (BL2).
2. Interpretthe direct and indirect band gap semiconductors(BL2).
3. Identifythe type of semiconductor using Hall effect(BL3) .
4. Identifyapplications of semiconductors in electronic devices(BL3)

MODULE-5	**SUPERCONDUCTORS AND NANOMATERIALS**	**8 h**

Superconductors- Properties, Meissner's effect, BCS Theory, Josephson effect (AC &DC), Types of Super conductors, Applications of superconductors. Nano materials – Significance of nanoscale , Properties of nanomaterials: Physical, mechanical, Magnetic, Optical ; Synthesis of

nanomaterials: Top-down-Ball Milling, Bottom-up –Chemical vapour deposition ; Applications of Nano materials.

At the end of the Module 5, students will be able to:

1.Explain how electrical resistivity of solids changes with temperature(BL2)
2.Classify superconductors based on Meissner's effect (BL2)
3.Explain Meissner's effect, BCS theory & Josephson effect in superconductors (BL2)
4.Identify the nano size dependent properties of nano materials (BL3)
5.Illustrate the methods for the synthesis and characterization of nano materials (BL2)
6.Apply the basic properties of nano materials in various Engineering branches (BL3)

MODULE-6	**LASERS & OPTICAL FIBERS**	**7 h**

Lasers: Spontaneous & stimulated emission of radiation, Population inversion, Pumping methods, Properties of lasers- monochromaticity, coherence, directionality, brightness, Types of lasers: Nd-YAG Laser, He–Ne Laser, Semiconductor laser; Applications.
Introduction to Optical Fibers-Total Internal Reflection-Critical angle of propagation-Acceptance angle-Numerical Aperture-Classification of fibers based on Refractive index profile-advantages of optical fibres.

At the end of the Module 6, students will be able to:

1. describe Spontaneous & stimulated emission of radiation (BL2)
2. Understand the basic concepts of LASER light Sources (BL2)
3. describe the construction and working of different types of Lasers (BL2)
4. identify the applications of lasers in various fields (BL3)

Content beyond syllabus:
Polarization of light.

Self-Study:
Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	WAVE OPTICS	CO1	https://youtu.be/n65gZGwiZtk
2	INTRODUCTION TO QUANTUM MECHANICS	CO2	https://youtu.be/w7Wf3Wr0guA?list=PL1955A15B7F28A7F https://youtu.be/NfkJKIoExYo?list=PL1955A15B7F2827F
3	FREE ELECTRON THEORY OF METALS	CO3	https://youtu.be/L-eOdZFt9BY https://youtu.be/G2zgAs5O7I8
4	INTRODUCTION TO SEMICONDUCTORS	CO4	https://youtu.be/BQijtvYxgIM https://youtu.be/rzxCRJcFaIw
5	SUPERCONDUCTORS AND NANOMATERIALS	CO5	https://youtu.be/GglT1RoBPzg https://youtu.be/iiT_KJJ1Uhs
6	LASERS	CO6	https://youtu.be/eoOM0Gx6GJc https://youtu.be/RyY4PEpV2RQ

Total hours:	**48 hours**

Text Book(s):

1. M. N. Avadhanulu, P.G. Kshirsagar& TVS Arun Murthy" AText book of Engineering Physics"- S. Chand Publications, 11th Edition 2019.
2. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2012.
3. S.O.Pillai, "Solid State Physics", 8th edition, New Age International Publishers, 2018.

Reference Book(s):

1. Shatendra Sharma, Jyotsna Sharma, " Engineering Physics", Pearson Education,2018
2. N. Subrahmanyam, BrijLal, *A Textbook of Optics*, S. Chand, New Delhi, 2015
3. Kittel, C. ―Introduction to Solid State Physics‖. Wiley, 2005.
4. K. Thyagarajan, *Engineering Physics*, McGraw-Hill Education (India) Pvt. Ltd, 2016.
5. AjoyGhatak, *Optics*, 5th Edition, McGraw Hill, 2012
6. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.
7. William T. Silfvast, "Laser Fundamentals" 2nd edition, Cambridge University Press, 2004.
8. T. Pradeep, "A Text Book of Nanoscience and Nanotechnology", Tata Mc Graw Hill, 2003

Online Resources:

1. http://www.peaceone.net/basic/Feynman/
2. http://physicsdatabase.com/free-physics-books/
3. http://www.damtp.cam.ac.uk/user/tong/statphys/sp.pdf
4. http://www.freebookcentre.net/Physics/Solid-State-Physics-Books.html

Web Resources:

1. http://link.springer.com/book
2. http://www.thphys.physics.ox.ac.uk
3. http://www.sciencedirect.com/science
4. http://www.e-booksdirectory.com

NARAYANA ENGINEERING COLLEGE:NELLORE								
20ES1001	**PROBLEM SOLVING AND PROGRAMMING**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	48	3	40	60	100

Pre-requisite: Mathematics Knowledge, Analytical and Logical skills

Course Objectives:

1. To understand various steps in Program development.
2. To understand the basic concepts in C Programming Language.
3. To learn how to write modular and readable C Programs.
4. To learn the syntax and semantics of a C Programming language.
5. To learn structured programming approach for problem solving.

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

CO 1	Understand the peripherals, ports and connecting cables and able to assemble the system. [BL- 2]
CO 2	Apply algorithmic approach to solve computational problems. [BL -3]
CO 3	Apply modular approach for solving the problems by using the control structures. [BL-3]
CO 4	Select the individual data elements to simplify solutions and provide efficient memory utilization. [BL-3]
CO 5	Develop sorting algorithms for heterogeneous data. [BL-3]
CO 6	Explain User-Defined Data Types and Files. (BL - 2)

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	1										
CO2	3	3												
CO3	3	3	3											
CO4	3	3	3											
CO5	3	3	2											
CO6	3	3	1											

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	**FUNDAMENTALS OF COMPUTERS AND PROGRAMMING**	**8h**

Fundamentals of computers: History of Computers, Generations of Computer, The Computer System - The Input-Process-Output Concept, Components of Computer System, Operating System - Introduction, Objectives, Functions.

Introduction to Programming, Algorithms and Flowcharts: Programs and Programming, Programming languages, Compiler, Interpreter, Structured Programming Concept, Algorithms, Flowcharts, How to Develop a Program.

Fundamental Algorithms: Exchanging the values of Two Variables, Counting, Summation of a setof numbers, Factorial computation, Generation of the FibonacciSequence, Reversing the digits of an integer.

At the end of the Module 1, students will be able to:

1. Illustrate the working of a Computer. (BL - 2)
2. Solve problems using language independent notations. (BL - 3)
3. Understand the compilers and interpreters. (BL - 2)
4. Understand Structured Programming. (BL - 2)
5. Develop algorithms and flowcharts for problems.(BL - 3)

MODULE -2	BASIC ELEMENTS OF C	7 h
Basics of C: Introduction**,** Character Set, Structure of a C Program, A Simple C Program, Variables, Data Types and Sizes, Declaration, How does The Computer Store Data in Memory, Identifiers, Keywords, Constants, Assignment, and Initialization. **Operators and Expressions:** Arithmetic Operators, Relational Operators, Logical Operators, Bitwise Operators, Conditional Operator, Comma operator, size of operator, Expressions, L values and R values, Expression Evaluation- Precedence and Associativity, Type Conversion.		
At the end of the Module 2, students will be able to: 1. Understand the basic structure of a program in C. (BL - 2) 2. Understand tokens in C language.(BL - 2) 3. Illustrate the working of expressions.(BL - 2) 4. Understand the precedence and Associativity rules of operators. (BL - 2) 5. Understand the rules of type conversion. (BL - 2)		
MODULE-3	**DATA INPUT / OUTPUT AND CONTROL STATEMENTS**	**8 h**
Input and Output: Basic Screen and Keyboard I/O in C, Formatted Input and Output, Unformatted Input and Output Functions **Control Statements:**Selection Statements - if, Nested if, if-else, Nested if-else, else-if ladder, switch Looping Statements - while, do-while, for, Nested loops, Unconditional Statements - goto, break, continue, return.		
At the end of the Module 3, students will be able to: 1. Explain the Formatted and Unformatted I/O functions. (BL - 2) 2. Understand Selection Statements. (BL - 2) 3. Understand Looping Statements. (BL - 2) 4. Explain Unconditional Statements. (BL - 2)		
MODULE-4	**FUNCTIONS AND PROGRAM STRUCTURE**	**8 h**
Functions: Introduction, Using Functions, Passing Arguments to a Function, Working with Function, Scope and Extent, Recursion, The C Preprocessor. **Program Structure:** Storage classes, Automatic variables, External variables, Static variables, Register variables, Multifile programs.		
At the end of the Module 4, students will be able to: 1. Understand the basic concept of functions. (BL - 2) 2. Understand concept of Recursion and Preprocessor. (BL - 2) 3. Explain storage specifiers. (BL - 2)		
MODULE-5	**ARRAYS AND POINTERS**	**9 h**
Arrays and Strings: Introduction, One-Dimensional Array, Multidimensional Arrays, Passing Arrays to Function, Strings - Declaration, Initialization, Printing Strings, String Input, Character Manipulation, String Manipulation, Arrays of Strings. **Pointers:** Fundamentals, Pointer Declarations, Operations on pointers, Passing Pointers to a Function, Pointers and Arrays, Arrays of Pointers, Pointer to Pointer, Pointer to Functions, Command line arguments, Dynamic Memory Management.		
At the end of the Module 5, students will be able to: 1. Understand the concept of Arrays. (BL - 2) 2. Understand the concept of pointers. (BL - 2) 3. Explain Dynamic Memory Management. (BL -2)		
MODULE-6	**USER-DEFINED DATA TYPES AND FILES**	**8 h**
Structures and Unions: Basics of Structures, Nesting of Structures, Arrays of Structures, Structures and Pointers, Structures and Functions, Self-Referential Structures, Unions, Bit-fields, Enumerations, typedef. **Files:** Introduction, Using Files in C, Working with Text Files, Random Accesses to Files of Records.		
At the end of the Module 6, students will be able to: 1. Explain user defined data types. (BL - 2) 2. Understand the concept of Self-Referential Structures. (BL - 2)		

3. Understand the working of files. (BL - 2)	
Total hours:	**48 Hours**

Content Beyond Syllabus:

1. Analysis of Algorithms
2. Binary Files
3. Variable Length Argument Lists

Self-Study:

Contents to promote self-Learning:

S. No	Module	Reference
1	Fundamentals of Computers and Programming	https://nptel.ac.in/courses/106/106/106106127/ [Lec1] https://nptel.ac.in/courses/106/105/106105214/ [Week 1 - Lec 1 To 2] https://nptel.ac.in/courses/106/105/106105171/ [Week 1 - Lec 1 To 4]
2	Basic Elements of C	https://nptel.ac.in/courses/106/105/106105171/ [Week 1 - Lec5] https://nptel.ac.in/courses/106/105/106105171/ [Week 2 - Lecture 7 To 10] https://nptel.ac.in/courses/106/105/106105171/ [Week 3 - Lec 11 To 14] https://nptel.ac.in/courses/106/106/106106127/ [Lec2] https://nptel.ac.in/courses/106/106/106106127/ [Lec3] https://nptel.ac.in/courses/106/106/106106127/ [Lec4]
3	Data Input / Output and Control Statements	https://nptel.ac.in/courses/106/106/106106127/ [Lec5] https://nptel.ac.in/courses/106/105/106105171/ [Week 3 - Lec15] https://nptel.ac.in/courses/106/105/106105171/ Week 4 - Lec 16 To 20] [Week 5 - Lec 21 To 25] https://nptel.ac.in/courses/106/106/106106127/ [Lec 6 &7]
4	Functions and Program Structure	https://nptel.ac.in/courses/106/105/106105171/ [Week 7 - Lec35] [Week 8 - Lecture 36 To 40] https://nptel.ac.in/courses/106/105/106105171/ [Week 11 - Lec 53 To 54] https://nptel.ac.in/courses/106/106/106106127/ [Lec 20 To 27]
5	Arrays and Pointers	https://nptel.ac.in/courses/106/105/106105171/ [Week 6 - Lec 26 To 30][Week 7 - Lec 32 To 34,48] [Week 12 - Lec 58, 59, 61] https://nptel.ac.in/courses/106/106/106106127/ [Lec 9 To 19]
6	User-Defined Data Types and Files	https://nptel.ac.in/courses/106/105/106105171/ [Week 11 - Lec 55, 56, 57, 60] https://nptel.ac.in/courses/106/106/106106127/ [Lec 36, 37, 38] https://nptel.ac.in/courses/106/106/106106127/ [Lec60]

Text Book(s):

1. Pradip Dey, and Manas Ghosh, "Programming in C", 2018, Oxford University Press.
2. Byron Gottfried, Schaum's Outline of Programming with C, 4th Edition, 2018, McGraw-Hill

Reference Books :

1. Brian W. Kernighan, and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Pearson.
2. Ajay Mittal, Programming in C: A Practical Approach , 3/e, Pearson Publication
3. SCHILDT and HERBERT, C: The Complete Reference,4th Edition, McGraw Hill, 2020
4. SOMASHEKARA, M. T., GURU, D. S., MANJUNATHA, K. S., Problem Solving with C,2nd Edition, PHI Learning, 2018
5. Paul Deitel, Deitel& Harvey Deitel, C How to Program,6th Edition, Pearson Education
6. Jeri R. Hanly, Elliot B. Koffman, Ashok Kamthane and A.Ananda Rao, Programming in C and Data Structures, 1st Edition, Pearson Education, 2010.
7. H.Cheng, C for Engineers and Scientists, Mc.Graw-Hill International Edition Education / PHI, 2009
8. Yashavant P. Kanetkar, Let us C, 16th Edition, BBP Publications, Delhi, 2017.
9. R.G. Dromey, "How to Solve it by Computer". Pearson,2014.
10. Anita Goel, Computer Fundamentals, Pearson Publication,2010.

Online Resources / Web Resources:

1. https://nptel.ac.in/courses/106/105/106105171/
2. https://nptel.ac.in/courses/106/106/106106127/
3. https://www.youtube.com/playlist?list=PLVlQHNRLflP8IGz6OXwlV_lgHgc72aXlh
4. https://www.youtube.com/watch?v=8PopR3x-VMY
5. https://www.youtube.com/watch?v=vl794HKeXug
6. https://books.goalkicker.com/CBook/
7. https://www.tutorialspoint.com/cprogramming/index.htm
8. https://www.programiz.com/c-programming
9. https://www.javatpoint.com/c-programming-language-tutorial
10. https://www.edureka.co/blog/c-programming-tutorial/
11. https://data-flair.training/blogs/c-tutorial/
12. https://www.programmingsimplified.com/c-program-examples
13. https://www.w3schools.in/category/c-tutorial/
14. C Programming Notes for Professionals book : https://books.goalkicker.com/CBook/

NARAYANA ENGINEERING COLLEGE :: NELLORE								
20EN1001	ENGLISH							R2020
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
I	**2**	**0**	**0**	**32**	**2**	**40**	**60**	**100**

Pre-requisite: Knowledge of fundamentals of English Language & Grammar

Course Objectives:

1. To enhance the linguistic and communicative competence.
2. To improve the Language proficiency of students in English with an emphasis on Vocabulary, Reading and Writing skills.
3. To provide knowledge of grammatical structures & rules and encourage their appropriate use.
4. To expose the students to Reading skills and apply the skill & strategies of a successful reader
5. To acquaint the students with effective strategies of paragraphs, note making, text editing, review writing and formal correspondence such as letter writing, e mail, and memos.
6. To aid the students acquire appropriate and adequate knowledge on writing Technical Reports.

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

CO 1	Practice the formulating appropriate sentences with Grammatical accuracy and also develop concept of word formation. .(BL3)
CO 2	Describe coherent and unified paragraphs with adequate support and detail and can write a topic sentence, support and concluding sentence. (BL2)
CO 3	Employ the writing and life skills in structural manner of real time scenarios. (BL-2)
CO 4	Explain the grammar rules for synthesis of sentences and use prewriting strategies to plan to write dialogues, reviews and edit the text effectively.(BL - 2)
CO5	Interpret the skills and sub skills of reading and use strategies for reading effectively and provide knowledge on the structure and format of technical writing.(BL - 3)
CO6	Use the concepts of various real time scenarios to represent in an effective model. (BL - 3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1										3				
CO2									2	3				
CO3										3				
CO4									2	3				
CO5									3	3				
CO6									3	3				

1: Low, 2-Medium, 3- High

COURSE CONTENT		
Module – I	**GRAMMAR& VOCABULARY BUILDING**	**6h**

Grammar : Parts of speech: Noun (Countables & Uncountables, Singulars & Plurals, Kinds of Nouns), Pronoun, Verb, Adverb, Adjective - Kinds of Sentences & Sentence Structures – Question forms – Word order in Sentence

Vocabulary Building : Concept of word formation – Synonyms & Antonyms – Homonyms & Homophones – Prefixes & suffixes – Commonly confused Words – One word substitutes – Idioms & Phrasal Verbs

At the end of the Module 1, students will be able to:

1. Acquire in depth knowledge on basic grammar concepts.
2. Understand the meaning of suffixes & Prefixes, idioms and phrasal verbs.
3. Learn meaning and usage of Vocabulary.

Module – II	**GRAMMAR&WRITING -I**	**8h**

Grammar : Subject Verb agreement – Pronoun-antecedent agreement – Verbs: auxiliary verbs (Primary & Modal)- Tenses

Writing : Principles of writing: clarity, simplicity, brevity, single focus, organization of thoughts - Sentence Structure – Joining the sentences - sequencing the ideas - introduction and conclusion – Punctuation.

At the end of the Module II, students will be able to:

1. Learn to use sentences clearly.
2. Understand the usage of grammar.
3. Learn the importance of use of Auxiliary verbs.

Module – III	**GRAMMAR&WRITING-II**	**10h**

Grammar : Direct & Indirect Speech – Active and Passive Voice – Comparison of Adjectives – Articles – Prepositions

Writing : Paragraph Writing - Phrases & Clauses – Conditionals - Business letters and Emails and Memos - Structure/ template of common business letters and emails: inquiry/ complaint/ placing an order

At the end of the Module III, students will be able to:

1. Understand and learn the nuance of writing business letters, e-mails, memos and effective paragraphs
2. Learn to use devices of coherence & cohesion with adequate support &detail
3. Learn the use of prepositions and active & passive voice in engineering and scientific contexts.

Module – IV	**GRAMMAR&WRITING-III**	**10h**

Grammar : Phrasal Verb – Cause and effect – Verb noun Collocations & adjective-noun collocations – correcting common errors in grammar and usage - Misplaced modifiers, idiomatic expressions

Writing : Note Making- organizing techniques: providing a suitable title, headings and sub headings; methods of sequencing - Paraphrasing -techniques of paraphrasing: Replacement of words and phrases, change of sentence structures.

At the end of the Module IV, students will be able to:

1. Understand the usage of phrases and clauses in sentences
2. Learn grammatical rules to encourage their appropriate use in writing
3. Learn to write effective note making and paraphrase

Module – V	**GRAMMAR&WRITING-IV**	**8h**

Grammar : Question formation (Wh- questions, Yes or No questions, Tag questions)-If Clauses— Simple, Compound, Complex Sentences - Correcting common errors in grammar and usage

Writing : Editing short texts - Dialogue writing - Writing Definitions (short and long) – compare and contrast paragraphs- Writing of Reviews : Book / Play / Movie - focus on appropriate vocabulary and structure - language items like special vocabulary and idioms used

At the end of the Module V, students will be able to:

1. Acquire the knowledge of applying the grammatical rules for synthesis of sentences
2. Learn to write dialogues for various contexts
3. Learn to edit the text and writing reviews

Module – VI	**READING SKILLS**	**6h**

Reading Skills : Types of reading: Skimming, Scanning, Intensive & Extensive Reading - Effective Reading-Tips
Reading Comprehension
Scramble Sentences
Complete the passage using contextual clues
Identifying Main Ideas using Scanning Technique
Identifying Specific Ideas using Skimming Technique
Writing : Describing – Report Writing: definition - purpose – types – structure - formal and informal reports - stages in developing report- proposal, progress and final reports –examples

At the end of the Module VI, students will be able to:

1. Master the skills and sub skills of reading
2. Learn the structure and format of technical reports
3. Learn to write description of things, process, places and persons

Content beyond syllabus:

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Vocabulary for Aptitude & Recruitment Tests | Campus Jobs	CO1	**https://youtu.be/uzvZa2qEuWo**
2	Tips to Improve Verbal and Written Communication Skills	CO2	**https://youtu.be/6Y3NY0ERBxY**
3	How to write professional emails in English	CO3	**https://youtu.be/3Tu1jN65slw**
4	Introduction to Collocation	CO4	**https://youtu.be/-ouWOpo2Uh8**
5	**Error Spotting Questions in Campus Recruitment Tests**	CO5	https://youtu.be/Rz6-qjNrzCU
6	Reading Skills: How To Skim, Scan and Read for Detail Effectively	CO6	https://youtu.be/SRHNKzXxu6o

Text Books:

1. Green, David Contemporary English Grammar –Structures and Composition, MacMillan India,2014
2. Raymond Murphy's English Grammar with CD, Murphy, Cambridge UniversityPress,2012
3. Michael Swan, (2017) Practical English Usage (Practical English Usage), 4th edition, UK:OxfordUniversityPress.
4. Ashraf, M Rizvi. Effective Technical Communication. Tata McGraw-Hill,2006.

Reference Books

1. English Conversation Practice –Grant Taylor, Tata McGraw Hill,2009.
2. Hewings, Martin. Cambridge Academic English (B2). CUP,2012
3. Meenakshi Raman and Sangeeta Sharma, Professional Communication, Second Edition, Oxford University Press, India,2017
4. Michael McCarthy, Felicity O'Dell, (2015) English Vocabulary in Use Advanced(South Asian Edition), UK: Cambridge UniversityPress
5. Spoken English, R.K. Bansal & JB Harrison, Orient Longman,2013, 4Thedition.

Web References:

1. *Grammar/Listening/Writing1-language.com*
2. *http://www.5minuteenglish.com/*
3. *https://www.englishpractice.com/*

Grammar/Vocabulary

1. *English Language LearningOnline*
2. *http://www.bbc.co.uk/learningenglish/*
3. *http://www.better-english.com/*
4. *http://www.nonstopenglish.com/*
5. *https://www.vocabulary.com/*
6. *BBC Vocabulary Games*
7. *Free Rice VocabularyGame*

Reading

1. *https://www.usingenglish.com/comprehension/*
2. *https://www.englishclub.com/reading/short-stories.htm*
3. *https://www.english-online.at/*
4. *https://learningenglish.voanews.com/z/3613*
5. *http://www.englishmedialab.com/listening.html*

Speaking

1. *https://www.talkenglish.com/*
2. *BBC Learning English – Pronunciation tips*
3. *Merriam-Webster – Perfect pronunciationExercises*

All Skills

1. *https://www.englishclub.com/*
2. *http://www.world-english.org/*

Online Dictionaries

1. *Cambridge dictionary online :https://dictionary.cambridge.org/*
2. *MacMillan dictionary :https://www.macmillandictionary.com/*
3. *Oxford learner's dictionaries :https://www.oxfordlearnersdictionaries.com/*

NARAYANA ENGINEERING COLLEGE:NELLORE								
20PH1501	APPLIED PHYSICS LAB							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	0	0	3	36	1.5	40	60	100

Pre-requisite: Nil

Course Objectives:

1. To provide student to learn about some important experimental techniques in physics with knowledge in theoretical aspects so that they can excel in that particular field. To prepare students for performing requirement analysis and design of variety of applications.
2. To enable the students to understand the concepts of interference and diffraction and their applications.
3. To educate students to recognize the applications of laser in finding the wavelength, slit width and its role in diffraction studies
4. To make the students to understand the important parameters of optical fibres and metals

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

CO 1	Understand the importance of optical phenomenon like Interference, diffraction and dispersion
CO 2	Comprehend the role of lasers in diffraction and the importance of optical fiber parameters
CO 3	Recognize the importance of energy gap in the study of conductivity and Hall Effect in a semiconductor.
CO 4	Identify the Importance of four probe method in determination of resistivity of a given semiconductor

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1										2		
CO2	3	1				1						2		
CO3	3	1				1						2		
CO4	3	1										2		

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
Task -1: Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall effect.	
The objective :To determine a) sign of the charge carriers, b) charge carrier concentration, c) mobility of the charge carriers of a given semiconductor	CO 1
Task - 2: To determine the resistivity of semiconductor by Four probe method	
Objective:To determine the resistvity of semiconductor by Four probe method	CO 1
Task -3: Determine the energy gap of a given semiconductor diode.	
Objective:To plot characteristics between reverse saturation current and 103 /T and find out the approximate value of Energy Band Gap in PN junction diode	CO 1
TASK -4: Measurement of radius of curvature of a lens by Newton's rings method.	

Objective:To determine the wavelength of sodium light by Newton's Ring method The key idea behind Newtons ring experiment is the thin film formation between a plane-convex lens and a glass plate. Due to this thin film of air a path difference occurs in the waves which reflect from the lower surface of the lens and the top surface of the glass plate. As a result of it, they superimpose and develop the interference pattern.	CO 2
TASK -5: Determine the thickness of the wire using wedge shape method	
Objective:To calculate the thickness of a thin wire by forming interference fringes using an air wedge arrangement. The key idea behind this experiment is the formation of thin wedge shaped film between two plane glass plates. Due to this thin film of air, a path difference occurs between waves reflected from top and bottom surface of the film. On superimposition of these waves an interference pattern containing a number of straight line fringes will be produced	CO 2
TASK-6: Determination of wavelength by plane diffraction grating normal incidence method	
Objectives: 1.To understand the types of diffraction 2.To familiarize with the principle of diffraction in plane transmission grating 3. To know the procedure for standardization of the grating 4.To determine the wavelengths of prominent spectral lines of mercury spectrum. An arrangement, which is equivalents in its action to a large number of parallel slits of same width separated by equal opaque spaces is called diffraction grating. It is constructed by ruling fine equidistant parallel lines on an optically plane glass plate with the help of a sharp diamond point.	CO 2
TASK -7: Dispersive power of a diffraction grating	
objective: To determine Dispersive power of a diffraction grating When white light passes through a grating, different wavelengths undergo different angles of diffraction. Hence white light split up into different colours and diffraction spectra of different orders will be produced. The angular dispersion or dispersive power of a grating is defined as the rate of change of angle of diffraction with the change of wavelength in a particular order of the spectrum.	CO 2
TASK -8: Determination of wavelength of LASER light using diffraction grating	
Objectives :1. To determine the concept of diffraction 2. To determine the wavelength of the given Laser source.	CO 3
TASK -9:Laser: Diffraction at a single slit	
Objective:Determination of width of a given single slit using laser diffraction method Laser beam has high monochromaticity,coherence and directionality. Hence it forms a clear diffraction pattern and we can measure width of a single slit accurately.	CO 3
TASK -10 Laser: Diffraction at a double slit	
Objective:Determination of width of a given double slit using laser diffraction method. With this experiment we can demonstrate diffraction nature of lasers and measure width of a double slit accurately.	CO 3
Additional Experiments:	
TASK -11 To determine the numerical aperture and acceptance angle of a given optical fibre	

Objective: To determine the numerical aperture and acceptance angle of a given optical fiber. In optical fibres light travel by multiple total internal reflections. Numerical aperture represents light gathering powerof optical fibre. Acceptance angle represents maximum limiting angle at one end of optical fibre for the liglht ray to travel by multiple total internal reflections through the core region of thefibre. 1. Optical fibers may be used for accurate sensing of physical parameters and fields like pressure, temperature and liquid level. 2. For military applications like fiber optic hydrophones for submarine and underwater sea application and gyroscopes for applications in ships, missiles and aircrafts.	CO 4

TASK -12: Determination of Fermi energy of a metal.	
Objective: To determine Fermi energy of a metal. Fermi energy represents highest energy level occupied by the electron at 0 K in a metal.	CO4
Virtual lab: 1) Laser beam divergence and spot size https://vlab.amrita.edu/?sub=1&brch=189&sim=342&cnt=1 2.Michelson's Interferometer- Wavelength of laser beam https://vlab.amrita.edu/?sub=1&brch=189&sim=1106&cnt=1 3.Anderson's Bridge https://vlab.amrita.edu/?sub=1&brch=192&sim=859&cnt=1	

Text Book(s):

1. C. L. Arora, “Practical Physics”, S. Chand & Co., New Delhi, 3rd Edition, 2012.
2. Vijay Kumar, Dr. T. Radhakrishna, “Practical Physics for Engineering Students”, S M Enterprises, 2nd Edition, 2014.

Reference Book(s):

1. S. Balasubramanian, M.N. Srinivasan “A Text book of Practical Physics”- S Chand Publishers, 2017.
2. C.H. Bernard and C.D. Epp, John Wiley and Sons, "Laboratory Experiments in College Physics" Inc., New York, 1995.
3.Dr.Ruby Das, C.S.Robinson, Rajesh Kumar and Prasanth Kumar “A text book of Engineering Physics Practical”, 1st edition, Sahu University Science Press, 2010.
4.Jayaraman, “Engineering Physics Laboratory Manual”, 1st edition, Pearson Education, 2014.

Web Resources:

1. https://www.scribd.com/doc/143091652/ENGINEERING-PHYSICS-LAB.
2. https://www3.nd.edu/~wzech/LabManual_0907c.pdf.
3.https://www.morebooks.de/store/gb/book/engineering-physics-lab-manual/isbn/978-3-330-34402.

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EN1501	ENGLISH LANGUAGE LAB							R2020
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
I	**0**	**0**	**3**	**48**	**1.5**	**40**	**60**	**100**
Pre-requisite:Basic English Grammar								

Course Objectives:

1. To expose the students to develop knowledge and awareness of English phonetics be able to read and produce phonemictranscriptions
2. To sensitize the students to the nuances of English speech sounds, word accent, intonation and rhythm
3. To develop strategies appropriately to improve one's ability to listen and Use listening skills to create more effective, less confrontational, more productive professional and personal communication
4. To demonstrate his/her ability to write error free writtencommunication
5. To distinguish main ideas from specific details and make use of contextual clues to infer meanings of unfamiliar words fromcontext
6. To provide a structured methodology for participants to prepare and deliver an effective, high impact presentation that meets the objectives and bringsresults

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

CO 1	Understand how speech sounds are used to create meaning. Apply their knowledge of English phonetics and phonology to improve their own pronunciation.
CO 2	Recognize and use pitch patterns to signal complete and incomplete thought groups and Speak confidently and intelligibly within groups and before an audience.
CO 3	Discuss and respond to content of a lecture or listening passage orally and/or in writing and make inferences and predictions about spoken discourse
CO 4	Produce coherent and unified paragraphs with adequate support and detail and can write a paragraph with a topic sentence, support, and concluding sentence

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	SO 1	PSO 2
CO1									2	3				
CO2									3	2				
CO3									3	3				
CO4									3	2				

1: Low, 2-Medium, 3- High

COURSE CONTENT	
Module - 1	
Introduction to Phonetics : IntroductiontoSounds of Speech – Vowels – Consonants - Listening with a focus on pronunciation Reading Newspaper – Highlighting Vowels and Consonants	**CO1**
Module – 2	
Syllabification: Word Stress, Rules of word stress Practice on Intonationand Stress	**CO2**
Module – 3	
Listening Skills : Types of Listening Skills	

Active listening and anticipating the speaker Listening for Specific & General Details Listening Comprehension	**CO3**
Module – 4	
Defining & Describing: Objects, Places and Events VideoSpeech Writing Review Writing (Books / Movies / Products..etc.,)	**CO4**
Module – 5	
Reading Comprehension Everyday English – Grammar, Vocabulary, LSRW Skills, Summarizing and Note making Vocabulary Building	**CO5**
Module – 6	
JAM Role Play Giving and Asking Directions Information Transfer	**CO6**

Text Book(s):

1. A Textbook of English Phonetics for Indian Students 2nd Ed T.Balasubramanian.(Macmillian),2012
2. SkillfulLevel2Reading&WritingStudent'sBookPack(B1)MacmillanEducational.

Reference Book(s): English Pronunciation in Use. Intermediate & Advanced, Hancock, M. 2009.CUP

1.Rizvi,Ashraf.M.,EffectiveTechnicalCommunication,McGrawHill,NewDelhi.2005

2Raman, Meenakshi &Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, New Delhi.2011

Web References:

1. Grammar/Listening/Writing 1-language.com
2. http://www.5minuteenglish.com/
3. https://www.englishpractice.com/ Grammar/Vocabulary
4. English Language Learning Online
5. http://www.bbc.co.uk/learningenglish/
6. http://www.better-english.com/
7. http://www.nonstopenglish.com/
8. https://www.vocabulary.com/
9. BBC Vocabulary Games
10. Free Rice Vocabulary Game Reading
11. https://www.usingenglish.com/comprehension/
12. https://www.englishclub.com/reading/short-stories.htm
13. https://www.english-online.at/ Listening
14. https://learningenglish.voanews.com/z/3613
15. http://www.englishmedialab.com/listening.html Speaking
16. https://www.talkenglish.com/
17. BBC Learning English – Pronunciation tips
18. Merriam-Webster – Perfect pronunciation Exercises All Skills
19. https://www.englishclub.com/
20. http://www.world-english.org/

21. http://learnenglish.britishcouncil.org/

Online Dictionaries

- Cambridge dictionary online :https://dictionary.cambridge.org/
- MacMillan dictionary :https://www.macmillandictionary.com/
- Oxford learner's dictionaries :https://www.oxfordlearnersdictionaries.com/

Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	0	0	2	32	1	40	60	100

Pre-requisite:

Course Objectives:

1. To introduce electronic components, measuring instruments and tools used in Electronicworkshop.
2. To equip with the knowledge of understanding data sheets of electronic components.
3. To give practical experience on soldering the electronic components on a PCB
4. To introduce EDA tools and TINA Software
5. To provide knowledge about the different types of transmission media such as guided and unguided media.

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

CO 1	Understand the safety aspects in using the tools and equipments. (BL-2)
CO 2	Apply basic electrical engineering knowledge to make simple house wiring circuitsand check their functionality.(BL-3)
CO3	Understand to disassemble and assemble a Personal Computer and prepare the computer ready to use (BL-2)\
CO 4	Apply knowledge to Interconnect two or more computers for information sharing (BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2												
CO2	3	2												
CO3	3	2		1										
CO4	2	2												

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
Task-1: Familiarization of commonly used tools in Electronics and Communication.	**CO 1**
Objective: To introduce tools used in Electronics and Communication.	
Task-2: Familiarization of Electronic Measuring Instruments	**CO 1**
Objective: To introduce measuring instruments used in Electronics and Communication.	
Task-3: Familiarization/Identification of electronic components	**CO 1**
Objective: To introduce electronic components used in Electronics.	
Task-4: Testing of electronic components	**CO 2**
Objective: To introduce Testing Procedure used for Electronic components	
Task-5: Study of Cathode Ray Oscilloscope (CRO)	**CO 1**
Objective: To study controls of CRO and measure Amplitude, Frequency and Phase of time varying signals.	
Task-6: Single Side PCB Fabrication	**CO 2**

Objective: To provide in-depth core knowledge in the fabrication of Printed Circuit Boards.	
Task-7: Introduction to EDA Tools	**CO 3**
Objective: To introduce EDA tools.	
Task-8: Assembling and Testing of simple electronic circuits on breadboards	**CO 2**
Objective: To give practical expose of electronic circuits on a Breadboard	
Task-9: To familiar with the optoelectronic devices	**CO 2**
Objective: To give practical experience on the different types of optoelectronic devices such as LED, photodiode, LDR, Photo Transistor and Photo Isolator.	
Task -10: To study about the transmission media	**CO 4**
Objective: To provide knowledge about the different types of transmission media such as guided and unguided media.	
Task-11: Familiarization of PA system with different microphones, loud speakers, mixer etc	**CO 2**
Objective: To give practical experience on Public addressing (PA) system.	
Task-12: To introduce about the TINA Software	**CO 3**
Objective: To introduce TINA tools.	
Additional Experiments	
Task 13: Interpret data sheets of discrete components and IC's	**CO 1**
Objective: To equip with the knowledge of understanding data sheets of electronic Components.	
Task14: Understand working of various Communication Systems	**CO 4**
Objective: To provide knowledge in understanding working of various communication Systems.	

Text Book(s):

1. G. Kennedy, B. Davis and Srm Prasanna," Electronic Communication Systems", TMH.
2. R S Khandpur, Printed Circuit Boards- Design Fabrication, Assembly and Testing, Tata Mc Graw Hill Publishing Company Limited, Ist edition 2008 .
3. TINA/ORCAD.PADS software User manual.
4. R.S. Sedha, "A Texk Book of Applied Electronics", S. Chand Publication.

Reference Book(s):

1. R.S. Sedha, "A Texk Book of Electronic Circuit", S. Chand Publication.
2. Dr K N Hari Bhat and Dr D Ganesh Rao, "Principles of Communication Systems", Cengage India.
3. Raghunandan G H, Raju hajare,"An Introduction to Basic Electronics Concepts and Applications - Concepts and Applications", Cengage Publications

Web References:

1. https://en.wikipedia.org/wiki/Electronic_test_equipment
2. https://www.electronicshub.org/basic-electronic-components/
3. https://www.makerspaces.com/basic-electronics/
4. https://predictabledesigns.com/electronic-lab-setup-tools-and-equipment-requirements/

NARAYANA ENGINEERING COLLEGE:NELLORE								
20ES1505	**ENGINEERING & ITWORK SHOP**							**R2020**
PART – A ENGINEERING WORK SHOP								
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	0	0	4	64	2	40	60	100

Pre-requisite: Basicmathematics.

CourseObjectives:

1. To know basic workshop processes and adopt safety practices while working with varioustoolsandequipments
2. To identify, select and use various marking, measuring, holding, striking and cutting tools&equipments.
3. Toknowabouttheinternalpartsofacomputer,assemblingacomputerfromtheparts,preparinga computerforusebyinstallingtheoperatingsystem
4. TogainknowledgeabouttheusageoftoolslikeWordprocessors,Spreadsheets,Presentations
5. TolearnaboutNetworkingofcomputersanduseInternetfacilityforBrowsingandSearching

CourseOutcomes:Aftersuccessfulcompletionofthecourse,thestudentwillbeableto:

CO1	Design and development of sheet metal objects by surface development and join the metals for obtaining desired shape.(BL-3)
CO2	Build a Personal Computer and Install operating systems and prepare the computer ready to use.(BL-3)
CO3	Develop presentation and documentation of a given tasks through Microsoft Windows and access the Internet & test Interconnect two or more computers for information sharing.(BL-3)

COURSE CONTENT (TRADES FOR PRACTICE)

Trade -1 Carpentry

Familiaritywithdifferenttypesofwoodsandtoolsusedinwoodworkingandmakefollowingjointsfromoutof 300x40x25mmsoftwoodstock.

a) Half–Lapjoint.

b) MortiseandTenonjoint

Trade-2 Fitting

i.]Familiarity with different types of tools used in fitting and do the fitting exercises out of 80 x 50 x 5 mm M.S. stock

a) V-fit b) Dovetail fit

Trade - 3 Sheet Metal Work

Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from out of 22 or 20 guage G.I. sheet

a) Tapered tray b) Conical funnel

Trade - 4 Electrical House Wiring

Familiarities with different types of basic electrical circuits and make thefollowingelectricalconnections

a) Two lamps in series

b) Two way switch

c) Tube light

d) Two lamps in parallel with 3 pin plug and switches

Trade 5 – Welding

Familiarity with different types of tools used in welding and do the following welding exercises

1. Single V butt joint
2. Lap joint

Text Book(s):

1. Hajra Choudhury S.K., Hajra Choudhury A.K., Nirjar Roy S.K. "Elements of WorkshopTechnology"Vol-I2008&Vol-II2010MediaPromoters&Publishers Pvt.Limited,Mumbai.
2. KalpakjianS.andStevenS.Schmid,"ManufacturingEngineeringand Technology" 4th Edition, Pearson Education IndiaEdition,2002.
3. P. Kannaiah&K. L. Narayana "Workshop manual" 2nd Ed., ScitechpublicationsPvt.Ltd.,Hyderabad,2008.

Reference Book(s):

1. Gowri P., Hariharan and Suresh Babu A., "Manufacturing Technology-I", Pearson Education2008.

WebResources:

1. https://www.muet.edu.pk/sites/default/files/images/users/41/Workshop%20Intro.pdf
2. http://ecoursesonline.iasri.res.in/mod/page/view.php?id=98826

PART-B IT WORKSHOP LAB	
Course Objectives: 1. To provide Technical training on Productivity tools like Word processors, Spreadsheets, Presentations. 2. To make the students know about the internal parts of a computer, assembling, installing the operating system. 3. To teach connecting two or more computers.	
Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Design and development of sheet metal objects by surface development and join the metals for obtaining desired shape.(BL-3)
CO 2	Build a Personal Computer and Install operating systems and prepare the computer ready to use.(BL-3)
CO 3	Develop presentation and documentation of a given tasks through Microsoft Windows and access the Internet & test Interconnect two or more computers for information sharing.(BL-3)

CO-PO Mapping														
	PO												PSO	
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1								2	2				
CO2	2								2	2			2	2
CO3	2								2	1			2	
1: Low, 2-Medium, 3- High														

COURSE CONTENT	CO
Task-1 Learn about Computer	
Identify the internal parts of a computer and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.	CO 1
Task -2 Assembling a Computer	
Disassemble and assemble the PC back to working condition. Troubleshoot the computer and identify working and non-working parts. Identify the problem correctly by various methods available (eg: beeps). Record the process of assembling and trouble-shooting a computer.	CO 1
Task-3 Install Operating system	CO 1
Install Linux, any other operating system (including proprietary software) and make the system dual boot or multi boot. Record the entire installation process.	
Task-4 Operating system features	CO 1
Record various features that are supported by the operating system(s) installed. Submit a report on it. Access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Install new application software and record the installation process.	
Task-5 Word Processor	CO 2
Create documents using the word processor tool. Tasks to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Prepare project cover pages, content sheet and chapter	

pages at the end of the task using the features studied. Submit a report of the word processor considered. Create documents using the word processor tool. Mail Merge in word processor for creating appointment orders for 10 employee records in excel.	
Task-6 Spreadsheet	CO 2
To create, open, save the spreadsheet and format them as per the requirement. Some of the tasks to be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells, working with pivot tables and charts. Submit a report of the Spreadsheet application considered.	
Task-7 Presentations	CO 2
To create, open, save and run the presentations, Select the style for slides, format the slides with different fonts, colors, create charts and tables, insert and delete text, graphics and animations, bulleting and numbering, hyperlink, set the time for slide show, Record slide show. Submit a report of the Presentation tool considered.	
Task-8 Wired network & Wireless network	CO 3
Select a LAN cable, Identify the wires in the cable, Define the purpose of each wire, Study the RJ45 connecter, Use crimping tool to fix the cable to the connecter, Test the cable using LAN tester, Connect two or more computers using cross and straight cables, Configure the computers, share the data between the computers.	

Additional Experiments:	
Task -1 IoT	CO 3
Raspberry Pi Study the architecture of Raspberry pi, configure software, Install SD card, Connect the cables, Install Raspbian (or any other) operating system, Configure Wi-Fi, Remotely connect to your Raspberry Pi.	
Task -2 Outlook, Macros	CO 3
Practice the following tasks and submit report A. Configure outlook and access mails. B. Create Macros in word and spreadsheet tools	

Text Book(s):

1. B.Govindarajulu, "IBM PC and Clones Hardware Trouble shooting and Maintenance",2nd edition, Tata McGraw-Hill, 2002
2. "MOS study guide for word, Excel, Powerpoint& Outlook Exams", Joan Lambert, Joyce Cox, PHI.
3. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.

Reference Book(s):

1. Rusen, "Networking your computers and devices", PHI
2. Bigelows, "Trouble shooting, Maintaining & Repairing PCs", TMH.

On-line/Web Resources:

https://turbofuture.com/computers/Dissassembling-and-Assembling-the-computer-system
https://www.instructables.com/id/Disassemble-a-Computer/
https://www.windowscentral.com/how-do-clean-installation-windows-10
https://www.tutorialspoint.com/ms_excel_online_training/index.asp
https://www.raspberrypi.org

NARAYANA ENGINEERING COLLEGE::NELLORE								
20ES1506	**PROBLEM SOLVING AND PROGRAMMING LAB**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	0	0	3	30	1.5	40	60	100

Pre-requisite: Mathematics Knowledge, Analytical & Logical Skills

Course Objectives:

1. To work with the compound data types
2. To explore dynamic memory allocation concepts
3. To able to design the flowchart and algorithm for real world problems
4. To able to write C programs for real world problems using simple and compound data types
5. To employee good programming style, standards and practices during program development

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

CO 1	Translate algorithms into programs (In C language) (BL - 2)
CO 2	Solve the problems and implement algorithms in C. (BL - 3)
CO 3	Make use of different data types to handle the real time data (BL - 3)

CO-PO Mapping

	PO												PSO	
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3											
CO2	3	3	3											
CO3	3	2	3	3										

1: Low, 2-Medium, 3- High

COURSE CONTENT	**CO**
Task-1	
1. Practice DOS and LINUX Commands necessary for execution of C Programs. 2. Study of the Editors, Integrated development environments, and Compilers in chosen platform. 3. Write, Edit, Debug, Compile and Execute Sample C programs to understand the programming environment.	CO 1
Task-2	
1. Practice programs: Finding the sum of three numbers, exchange of two numbers, largest of two numbers, to find the size of data types, Programs on precedence and associativity ofoperators, sample programs on various library functions.	CO 1
Task-3	
1. Write a C program to calculate the factorial of a given number 2. Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 & 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a Cprogram to generate the first n terms of the sequence. 3. Write a program to find the roots of a Quadratic equation.	CO1
Task-4	
1. Write a program to generate the series of prime numbers in the given range. 2. Write a program to reverse the digits of a number. 3. Write a C program to find the sum of individual digits of a positive integer.	CO 2

Task-5	
1. Write a program to check for number palindrome. 2. Write a program to find the maximum of a set of numbers. 3. Write a C program to find the GCD (greatest common divisor) of two given integers	CO 2
Task-6	
1. Write a program to find the sum of positive and negative numbers in a given set of numbers. 2. Write C code to reverse the elements of the array. For example, [1,2,3,4,5] should become [5,4,3,2,1] 3. Write a C program to find factorial of a given integer number using recursion	CO 3
Task-7	
1. Write a C program that use pointers to find Addition of Two Matrices 2. Write a C program that use functions to find Multiplication of Two Matrices	CO 3
Task-8	
1. Write a program to accept a line of characters and print the number of Vowels, Consonants, blank spaces, digits and special characters. 2. Write a C program to check whether a given string is a palindrome or not, without using anybuilt-in functions.	CO 3
Task-9	
1. Illustrate the use of auto, static, register and external variables. 2. Write a program to read and print student information using structures 3. Write a C program to define a union and structure both having exactly the same numbers using the sizeof operators print the sizeof structure variables as well as union variable	CO 4
Task-10	
1. Write a program to split a "file" into two files, say file1 and file2. Write lines into the 'file' from standard input. Read the contents from 'file' and write odd numbered lines into file1 and even numbered lines into file2. 2. Write a program to merge two files.	CO 4

Additional Experiments	
Task-1	
1. Programs on bitwise operators. 2. Programs on bit fields.	CO4
Task-2	
1. Write a program to read a set of strings and sort them in alphabetical order. 2. Programs on implementation of structures using files.	CO 4

Virtual Labs:	
1. Problem Solving Lab (IIIT HYDERABAD) :http://ps-iiith.vlabs.ac.in/	
List of Experiments	
1. Numerical Representation 2. Beauty of Numbers 3. More on Numbers 4. Factorials 5. String Operations	6. Recursion 7. Advanced Arithmetic 8. Searching and Sorting 9. Permutation 10. Sequences
2. Computer Programming Lab (IIIT HYDERABAD) :http://cse02-iiith.vlabs.ac.in/	
List of Experiments	
1. Numerical Approximation 2. Functions 3. Advanced Control Flow 4. Arrays	6. Basic Control Flow 7. Pointers 8. Recursion 9. Expression Evaluation

5. Structures	

Text Book(s):

1. "How to Solve it by Computer", R.G. Dromey, 2014, Pearson.
2. Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A.Ananda Rao, Pearson Education, 1st Edition, 2010.

Reference Book(s):

1. "The C Programming Language", Brian W. Kernighan, Dennis M. Ritchie, 2nd Edition, Pearson.
2. "Let us C", YeswantKanetkar, BPB publications
3. "Pointers in C", YeswantKanetkar, BPB publications, 16th Edition, 2017
4. Computer Science, A Structured Programming Approach Using C by Behrouz A. Forouzan& Richard F. Gilberg, 3rd Edition, Cengage Learning
5. C Programming A Problem-Solving Approach, Behrouz A. Forouzan& E.V. Prasad, F. Gilberg, 3rd Edition, Cengage Learning
6. Programming with C RemaTheraja, Oxford, 2018
7. Programming in C, 3rd Edition, 2015, Ashok N. Kamthane, Pearson Education
8. Programming in C, 3/e : A Practical Approach by Ajay Mittal, Pearson Publication
9. Problem Solving with C by SOMASHEKARA, M. T., GURU, D. S., MANJUNATHA, K. S., PHI Learning, 2nd Edition, 2018
10. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press, 2001
11. Byron Gottfried, Schaum's Outline of Programming with C, 4th Edition, 2018, McGraw-Hill

Web Resources:

1. https://www.includehelp.com/c-programs/advacnce-c-examples.aspx
2. https://www.programiz.com/c-programming/examples
3. https://www.javatpoint.com/c-programs
4. https://www.w3resource.com/c-programming-exercises/
5. https://www.sanfoundry.com/simple-c-programs/
6. https://www.includehelp.com/c-programming-examples-solved-c-programs.aspx
7. http://www.c4learn.com/c-programs/tag/c-programs-typical-programs

NARAYANA ENGINEERING COLLEGE::NELLORE

AUTONOMOUS

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER II

Subject Code	Category	Course Title	Contact Periods per week				Credits	Scheme of Examination Max. Marks		
			L	T	P	Total		Int. Marks	Ext. Marks	Total marks
20CH1001	**BS**	Chemistry	3	0	0	3	3	40	60	100
20MA1004	**BS**	Vector Calculus and Transforms	3	1	0	4	4	40	60	100
20ES1004	**ES**	Basic Electrical Engineering	3	0	0	3	3	40	60	100
20ES1007	**ES**	Introduction to Python Programming	2	0	0	2	2	40	60	100
20CH1501	**BS**	Chemistry Lab	0	0	3	3	1.5	40	60	100
20ES1509	**ES**	Basic Electrical Engineering Lab	0	0	2	2	1	40	60	100
20ES1504	**ES**	Engineering Graphics Lab	0	1	4	5	3	40	60	100
20ES1510	**ES**	Introduction to Python Programming Lab	0	0	2	2	1	40	60	100
20EN1502	**HS**	Oral Communication Skills Lab	0	0	2	2	1	40	60	100
		Counselling/Mentoring	0	0	1	1	0	--	--	--
		Sports/Hobby Clubs/Activities	0	0	2	2	0	--	--	--
		Activity Point Programme	During the Semester					20 Points		
		Total	**11**	**2**	**16**	**29**	**19.5**	**360**	**540**	**900**

20CH1001	CHEMISTRY (COMMON TO ECE,EEE&CSE)						
Semester	Hours / Week			Total hrs	Credit		
	L	T	P		C	CIE	SEE
II	3	0	0	48	3	40	60

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Illustrate the molecular orbital energy level diagram of different molecular species. (BL-3)
CO 2	Make use the knowledge about various kinds of electro chemical cells in engineering applications. (BL-2)
CO 3	Interpret the various energy storage devices and emerging technologies in engineering applications. (BL-2)
CO 4	Understand the mechanism and applications of different polymers in electronic devices. (BL-2)
CO 5	Familiarize the various sources of renewable energy and their harnessing. (BL-2)
CO 6	Apply the spectroscopy methods for the analysis of engineering materials. (BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3													
CO2	3	2				2	2							
CO3	3					2	2							
CO4	3					2	2							
CO5	3	2					2							
CO6	3	2				2								

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	STRUCTURE AND BONDING MODELS	8 h

Planks quantum theory, photo electric effect,dual nature of matter -Debroglies equation ,Heisenberg uncertainty principle, molecular orbital theory – bonding in homo- and hetero nuclear diatomic molecules – energy level diagrams of O_2 and CO, etc. π-molecular orbital's of butadiene and benzene, calculation of bond order, crystal field theory – salient features – splitting in octahedral and tetrahedral geometry.

At the end of the Module 1, students will be able to:

1.Understand the fundamental concepts of chemistry to predict the structure, properties and bonding of Engineering materials.(BL-1)

2.Iillustrate the molecular orbital energy level diagram of different molecular species.(BL-2)

3.Apply crystal field theory for octa hydral and tetra hydralmolecule.(BL-3)

4.out line the planks quantum theory. .(BL-2)

5.Explain heisen berg uncertainty principal.(BL-2)

MODULE -2	ELECTRO CHEMISTRY	8 h

Electrode potential, EMF of an electrochemical cell,problems on emf Nernst equation;. Electrodes – concepts, reference electrodes (standard hydrogen, Calomel electrode, and glass electrode), potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductometric titrations (acid-base titrations), photovoltaic cell – working and applications.

At the end of the Module 2, students will be able to:

1. Demonstrate competency in the basic concepts of electrochemical cells.(BL-2)
2. Explain the significance of electrode potentials.(BL-2)
3. List the different types of electrodes.(BL-1)
4. Differentiate between , potentiometric and conductometric titrations. (BL-2)
5. Illustrate the construction of PV cell.(BL-2)

MODULE-3	**BATTERYTECHNOLOGY**	**7 h**

Basic concepts, classification of batteries, Important applications of batteries, Modernbatteries-zincair,lithiumcells- Li ion cell , Li-MnO_2cell, ni-cd cell, lead acid storage cell .FuelcellsIntroduction-classificationoffuelcells–hydrogen and oxygen fuel cell, methanol and oxygen fuel cell, SOFC - Merits of fuelcell

At the end of the Module 3, students will be able to:

1. Classify batteries into different types.(BL-2)
2. Explain the concept involved in the construction of batteries.(BL-2)
3. Identify the significance of batteries. .(BL-3)
4. Compare the merits of different fuel cells.(BL-2)
5. Distinguish between different types of batteries.(BL-2)

MODULE-4	**POLYMERCHEMISTRY**	**9h**

Basic concepts of polymer, chain growth and step growth polymerization, coordination polymerization, copolymerization with specific examples and mechanisms of polymer formation. Plastics - Thermoplastics and Thermosetting, Preparation, properties and applications of –pvc, Bakelite, urea-formaldehyde, Nylons-Elastomers–Buna-S, Buna-N–preparation, properties and applications. Conducting polymers – poly acetylene, poly aniline, mechanism of conduction and applications.

At the end of the Module 4, students will be able to:

1 Identify different types of polymers.(BL-3)
2. Distinguish between thermoplastic and thermo setting resins.(BL-2)
3. Explain the preparation, properties and applications of some plasticmaterials.(BL-2)
4. Apply the knowledge of advanced polymers, conducting polymers for different applications.(BL-3)
5.Outline the properties of polymers and various additives added and different methods of forming.plasticmaterials.(BL-2)

MODULE-5	**ENERGY SCIENCE**	**7 h**

fuels-classification of fuels characteristics solid fuels-coal, analysis of coal ,refining of petroleum, alternative and non conventional sources of Energy-solar, wind, Geo, Hydro power ,Bio mass advantages and disadvantages, Nuclear energy-Nuclear fission and fusion reactions Nuclear waste disposal

MODULE-6	**MODULE-VI INSTUMENTAL METHODS AND APPLICATIONS**	**9h**

Electronic Spectroscopy –EMR, Beer-Lambert's law and its, Applications, instrumentation of UV-visiblespectrophotometer.*IR Spectroscopy* - Types of vibrations, Instrumentation of IR spectrophotometer and its applications. Chromatography-Introduction ,Principle and instrumentation of Gas Chromatography (GC) and thin layer chromatography, separation of gaseous mixtures and liquidmixtures

At the end of the Module 6, students will be able to:

1. Explain the different types of spectral series in electromagnetic spectrum (BL-2)
2 .Understand the principles of different analytical instruments (BL-2)
3 .Explain the different applications of analytical instruments (BL-2)
4 .Outline the beers lamberts law.(BL-2)

Total hours:	**48hours**

Content beyond syllabus:

1. Band theory, vulcanization and compounding of rubber

Self-Study:

Contents to promote self-Learning:

S. NO	Topic	CO	Reference
1	Molecular orbital theory	CO1	https://www.youtube.com/watch?v=FMxuss0RXOU
2	Reference electrodes	CO2	https://www.youtube.com/watch?v=WMfXlncyMDc
3	battreies	CO3	https://nptel.ac.in/courses/103/108/103108162/
4	plastics	CO4	https://www.youtube.com/watch?v=FATc12opDCA
5	Non conventional energy recourses	CO5	https://swayam.gov.in/nd1_noc20_ge06/preview
6	Fundamentals of spectroscopy	CO6	https://swayam.gov.in/nd1_noc20_cy08/preview

Text Book(s):

1. P.C.Jain&MonikaJain,*EngineeringChemistry*,DhanpatRayPublishingCompany (P) Ltd, New Delhi, 16th edition, 2013.
2. K. N. Jayaveera, G. V. Subba Reddy and C. Ramachandraiah, *Engineering Chemistry*, McGraw Hill Publishers, New Delhi.
3. Energy scenario beyond2100,byS.Muthu Krishna Iyer.

Reference Book(s):

1. J. D. Lee, *Concise Inorganic Chemistry*, Oxford University Press, 5th edition2010.
2. Skoog and West, *Principles of Instrumental Analysis*, Thomson, 6th edition,2007.
3. Peter Atkins, Julio de Paula and James Keelar, *Atkins' Physical Chemistry*, Oxford University Press, 10th edition,2010.

Online Resources Web Resources:

1. https://drive.google.com/file/d/0Bz82vSA0C1xlWC11WkpsTmlwQVk/view
2. https://www.cgaspirants.com/2017/08/engineering-chemistry-by-jain-jain.html
3. https://www.pdfdrive.com/concise-inorganic-chemistry-d33405948.html
4. https://chemistry.com.pk/books/skoog-principles-of-instrumental-analysis1/
2. https://www.thermalfluidscentral.org/e-books/book-intro.php?b=39file:///C:/Users/DELL/Downloads/HandbookOfInstrumentalTechniquesForAnalyticalChemistryPDFDrive.com.pdf
3. https://nptel.ac.in/courses/104/106/104106096/
4. https://youtu.be/KHh_IX1G6uA
5. https://www.youtube.com/watch?v=MfbxR9ZDs0s&feature=youtu.be
6. .https://nptel.ac.in/courses/113/105/113105028/
7. https://www.youtube.com/watch?v=15MY7abeCDk
8. https://www.youtube.com/watch?v=UeGJpwC1aiQ&feature=youtu.be

NARAYANA ENGINEERING COLLEGE: NELLORE								
20MA1004	VECTOR CALCULUS & TRANSFORMS(VC&T)							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	1	0	64	4	40	60	100

Pre-requisite: Intermediate Mathematics

Course Objectives:

1. To illustrate the physical interpretation of gradient, divergence and curl
2. To apply the basic concepts of vector integration and their applications.
3. To understand the concepts of Laplace transforms and its properties.
4. To apply the concepts of Laplace, transform to solve the ordinary differential equations.
5. To understand the concepts of Fourier series.
6. To understand the concepts of Fourier transforms and its properties.

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

CO 1	Illustrate the physical interpretation of Gradient, Divergence and Curl in various engineering applications.(BL-3)
CO 2	Apply Green's, Stokes and Divergence theorem in the evaluation of double and triple integrals. (BL-3)
CO 3	Make use the concepts of Laplace transform to solve various engineering problems. (BL-3)
CO 4	Apply the Inverse Laplace transform techniques to solve differential equations arising in engineering field. (BL-3)
CO 5	Demonstrate Fourier series to study the behavior of periodic function and their applications in various fields of engineering .(BL-3)
CO 6	Apply the properties of Fourier transform to solve various engineering problems. (BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3											1	
CO2	3	3											1	
CO3	3	3											1	
CO4	3	3											1	
CO5	3	3											1	
CO6	3	3											1	

1- Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	VECTOR DIFFERENTIATION	9 h

Introduction to vector differentiation , Definition of Scalar and Vector point functions, Definition of Vector differential operator , , Gradient of a Scalar point function- Definition of Gradient of a scalar point function and properties (without proof) , Definition of Directional Derivative , Definition of level surface, Different Problems ,Divergence of a Vector point function - Definition, Definition of Solenoidal vector and problems , Curl of a vector point function - Definition of Curl, definition of Irrotational vector, Problems, Laplacian operator -Definition and related problems,Vector Identities–Statements(without proof).

At the end of the Module 1, students will be able to:

1. Understand the concepts of Vector Differentiation.(BL-2)
2. Apply del to scalar and vector point functions.(BL-3)

3. Illustrate the physical interpretation of gradient, divergence and curl.(BL-2) 4.Calculate directional derivatives and gradients (BL-1) 5.Apply Vector Differentiation concepts in fluid mechanics (BL-3)		
MODULE -2	**VECTOR INTEGRATION**	**11h**
Introduction to vector integration , Line integrals-Explanation ,Work done by a Force- Explanation, problems, , Surface integral-Explanation and formula for surface integrals(without proof), Problems, Volume integral- Explanation and formula for volume integral (without proof),Problems ,Green's Theorem-Statement (without proof),Problems , Gauss divergence Theorem- Statement (without proof),Problems, Stoke's theorem - Statement (without proof),Problems.		
At the end of the Module 2, students will be able to: 1.Find the work done in moving a particle along the path over a force field (BL-1) 2.Find the rate of fluid flow along and across curves .(BL-1) 3. Apply Green's, Stokes and Divergence theorem in double and triple integrals.(BL-3) 4.Use the divergence theorem in physical interpretation of the divergence of a Vector field. (BL-3) 5.Find the line integrals along simple closed curves on the Plane by Green's Theorem.(BL-1) 6.Apply Stokes' theorem in physical interpretation of the curl of a vector field. (BL-3)		
MODULE-3	**LAPLACE TRANSFORMS**	**12h**
Introduction to Laplace Transforms, Definition of Laplace Transforms, Sufficient conditions for the existence of the L.T of a function, Laplace Transforms of standard Functions, First Translation (or) First Shifting theorem, Problems. Second Translation (or) Second Shifting theorem, Problems. Change of scale property, Problems. L.T .of derivatives, Problems. L.T. of integrals, Problems. Multiplication by 't', Problems. L.T. of Division by 't', Problems. Evaluation of integrals by L.T.- problems. L.T. of some special functions, Unit Step Function or Heaviside's Unit Function- Definition, L.T problems, Unit Impulse Function or Dirac Delta function- Definition, problems. Laplace Transform of Periodic Functions-Statement (without proof), Problems.		
At the end of the Module 3, students will be able to: 1.Understand the concepts of Laplace transforms.(BL-2) 2. Solve Ordinary differential equations by Laplace transform techniques. (BL-3) 3. Find integrals by using Laplace transforms. (BL-1) 4. Understand the properties of the Heaviside (unit step) function, Dirac delta function and its applications. (BL-2)		
MODULE-4	**INVERSE LAPLACE TRANSFORMS**	**11h**
Definition of Inverse Laplace Transforms, Inverse Laplace Transforms of standard Functions (without proof), Problems. Use of Partial Fractions to find Inverse Laplace Transform- problems. First Translation (or) First Shifting theorem- Statement (without proof), problems. Second Translation (or) Second Shifting Theorem-Statement (without proof), Problems. Change of scale property- Statement (without proof), problems. Inverse L.T of derivatives- Statement (without proof), problems. Inverse L.T to finite integrals-Statement (without proof), problems. Multiplication byPowersof's'Statement(withoutproof),Problems.Divisionby's'Statement(withoutproof),problems.Convolution-theorem-statement (without roof), problems. Applications to Ordinary Differential Equations-Working method Explanation, problems.		
At the end of the Module 4, students will be able to: 1 Understand the concepts of inverse Laplace Transforms (BL-2) 2 Develop the wave functions by inverse Laplace transforms.(BL-6) 3 Obtain inverse Laplace transforms by Convolution Theorem (BL-3) 4 Develop the heat equations by using inverse Laplace transforms (BL-6) 5 Solve the higher order differential equations by the Laplace transform. (BL-3)		
MODULE-5	**FOURIER SERIES**	**11h**

Introduction to Fourier Series, Periodic function-definition, properties(without proof), Euler's formulae(without derivation), Dirichlet's conditions, Fourier series in $[0,2\pi]$,- formula(without derivation), Problems, Fourier series in $[-\pi, \pi]$- formula(without derivation), Problems, Fourier series for even and odd functions in $[-\pi, \pi]$- formula(without derivation), Problems, Fourier series in $[0,2l]$- formula(without derivation),problems, Fourier series in $[-l, l]$- formula(without derivation),problems, Fourier series for even and odd functions in $[-l, l]$- formula(without derivation), problems Half -Range Fourier sine Series in$(0, \pi)$ and $(0,l)$- Formula(without derivation), Problems, Half-Range Fourier cosine Series in$(0, \pi)$and$(0,l)$-Formula(without derivation),Problems.

At the end of the Module 5, students will be able to:

1. Find the Fourier series expansion of the given function. (BL-1)
2. Apply Fourier series and its properties in various engineering problems. (BL-3)
3. Find the Half-Range Fourier Sine & Cosine series in $(0, \pi)$ and $(0,l)$. (BL-1)
4. Understand the properties of periodic functions, represent it as a Fourier series (BL-2)

MODULE-6	**FOURIER TRANSFORMS**	**10h**

Introduction to Fourier Transforms, Fourier integral theorem Statement (without proof) , Fourier sine and cosine integrals formula(without derivation), problems, Fourier Transform formula(without derivation) &Inverse Fourier Transform formula (without derivation),Properties of Fourier Transforms (without proof), problems , Fourier Sine Transform formula & Inverse Fourier sine Transform formula (without derivation) , problems, Fourier Cosine Transform formula & Inverse Fourier cosine Transform formula (without derivation) , problems, Finite Fourier Sine Transform- Finite Fourier Sine Transform formula &Inverse finite Fourier sine transform formula (without derivation), problems, Finite Fourier Cosine Transform- Finite Fourier Cosine Transform formula & Inverse finite Fourier cosine transform formula (without derivation),problems.

At the end of the Module 6, students will be able to:

1. Understand the concepts of Fourier transforms. .(BL-2)
2. Apply the properties of Fourier transforms to various engineering problems.(BL-3)
3. Solve boundary value problems by Fourier integral transforms.(BL-3)
5. Make use of the Fourier transforms and its inverse in practical applications of engineering. (BL-3)

Total hours:	**64hours**

Content beyond syllabus: **NARAYANA ENGINEERING COLLEGE:NELLORE**

1. Orthogonal curvilinear co-ordinates
2. Cylindrical co-ordinates & Spherical polar co-ordinates
3. Complex Fourier series
4. Parseval's Identity for Fourier Transforms.
5. Application of Transforms to Boundary value problems.

Self-Study: Contents to promote self-Learning:

SNO	Topic	Reference
1	Vector Differentiation	https://youtu.be/a19x_YG0oLg
2	vector integration	https://youtu.be/pfCwRLK29h4https://youtu.be/KHiw9Vs-aLM
3	Laplace transforms	https://youtu.be/luJMl37-nsohttps://youtu.be/EDVJotmT584
4	Inverse Laplace transforms	https://youtu.be/9NqdBXNyJPkhttps://youtu.be/0ZlThUd-yyw
5	Fourier series	https://youtu.be/4cSZDHxyBf4
6	Fourier transforms	https://youtu.be/GtXmS5YH7XM

Text Book(s):

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers.
2. N.P. Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publication.
3. Ramana B.V., "Higher Engineering Mathematics", McGraw Hill Publishers

Reference Book(s):

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley.
2. Veerarajan T., "Engineering Mathematics" , Tata McGraw-Hill.
3. Dr. M Anita, "Engineering Mathematics-I", Everest Publishing House, Pune.

Online Resources/ Web References:

1. http://keralatechnologicaluniversity.blogspot.in/2015/06/erwin-kreyszig-advanced-engineering-mathematics-ktuebook-download.html
2. http://www.faadooengineers.com/threads/13449-Engineering-Maths-II-eBooks .
3. http://www.efunda.com/math/math_home/math.cfm
4. http://www.ocw.mit.edu/resources/#Mathematics
5. http://www.sosmath.com/
6. http://www.mathworld.wolfram.com/

20ES1004	BASIC ELECTRICAL ENGINEERING							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	3	0	0	48	3	40	60	100

Pre-requisite: Fundamental of mathematics and physics

Course Objectives:

1. To understand Types of electrical elements and KCL & KVL.
2. To analyze Peak and RMS values of AC circuits.
3. To understand Balanced and Unbalanced three Phase AC circuits .
4. Analyze EMF and Torque Equations of DC Machines.
5. To understand the Applications of Transformers and AC Machines.

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

CO 1	Analyze DC and AC circuits with different sources and with different reduction techniques. (BL-4)
CO 2	Analyze the AC circuits or systems. (BL-4)
CO 3	Apply different concepts to analyze the Three Phase Circuits. (BL-3)
CO 4	Discuss the operation and construction of DC machine. (BL-2)
CO 5	Interpret the operation and construction of single phase and three phase transformers and machines. (BL-2)
CO 6	Illustrate the working of single phase and three phase induction motors. (BL-2)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3										2	3
CO2	2	3	3										2	3
CO3	3	3	3	2									3	3
CO4	3	3	3	2									3	3
CO5	3	2	3	2										
CO6	3	3	3	2										

COURSE CONTENT

MODULE – 1	DC CIRCUITS	8h

Introduction to Voltage, Current, Power, Direct Current (DC), Alternating Current (AC), Difference between DC and AC, Applications of DC and AC - Types of electrical elements – Ohm's Law - Electrical circuit elements (R, L and C) – Voltage and Current sources – KCL & KVL – Analysis of simple (Series and Parallel) circuits with DC Excitation.

At the end of the Module 1, students will be able to:

1. Analysis of Series and Parallel circuits with DC Excitation(BL-2)
2. Understand the Voltage, Current, Power, Direct Current (DC), Alternating Current.(BL-2)
3. Explain the Electrical circuit elements (R, L and C).(BL-2)

MODULE -2	AC CIRCUITS	7h

Representation of sinusoidal waveforms – Peak and RMS values – Phasor representation – Real Power, Reactive Power, Apparent Power, Complex Power, Power Factor – Analysis of Single phase AC circuits consisting of R, L, C, RL, RC, RLC series and parallel circuits.

At the end of the Module 2, students will be able to:

1. Understand the Representation of sinusoidal waveforms, Peak and RMS values, Phasor representation of AC network. (BL-2)
2. Solve theReactive Power, Apparent Power, Complex Power, Power Factor of a AC circuits.

(BL-3)

3. Explain the Single phase AC circuits.(BL-2)

MODULE -3	NETWORK THEOREMS	9h

Super position theorem, Compensation theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Tellegen's theorem, Millman's theorem, Reciprocity theorem; Application of network theorems in solving DC and AC circuits.

At the end of the Module 3, students will be able to:

1. Understand the Application of network theorems in solving DC circuits. (BL-2)
2. Understand the Application of network theorems in solving AC circuits. (BL-2)
3. Explain various theorems. (BL-2)

MODULE -4	DC MACHINES	8h

Principle of operation of DC Generator - EMF Equation – Types of Generators – Magnetization and Load Characteristics – Applications – Principle of operation of DC Motor – Torque Equation – Types of Motors – Characteristics – Applications.

At the end of the Module 4, students will be able to:

5. Explain the Types of Generators. (BL-2)
6. Understand the Characteristics and Applications of DC Machines. (BL-2)
7. Explain the Torque Equation and Types of Motors. (BL-3)

MODULE -5	TRANSFORMERS	8h

Principle of operation of Single phase Transformer – Types – EMF Equation – Applications – Three phase AC Circuits (Balanced and Unbalanced) - Principle of operation of three phase Transformer – Application – Selection of single phase or three phase transformer at consumer premises.

At the end of the Module 5, students will be able to:

1. Explain the types of Transformer. (BL-2)
2. Explain the Applications of Transformer. (BL-2)
3. Understand the single phase and three phase transformer at consumer premises. (BL-2)

MODULE-6	AC MACHINES	8h

Principle of operation of Alternator – Characteristics- applications – Principle of operation of single phase Induction Motor – Characteristics – Applications - Principle of operation of three phase Induction Motor – Characteristics – Applications.

At the end of the Module 6, students will be able to:

1. Understand the concept of different type of AC machines. (BL-2)
2. Understand the Characteristics and Applications of AC Machines. (BL-3)
3. Explain the Principle of operation of three phase Induction Motor. (BL-2)

Total hours:	48 hours

Content beyond syllabus:

- Introduction to PSpice.
- Starting Methods of Polyphase Induction Motors
- Brake test of DC Motor

Self-Study:

Contents to promote self-Learning:

SNO	Topic	Reference
1	Introduction to the electrical circuit	https://nptel.ac.in/courses/117/106/117106108/
2	AC circuit	https://nptel.ac.in/courses/108/105/108105053/
3	DC Generators	https://nptel.ac.in/courses/108/102/108102146/ https://nptel.ac.in/courses/108/105/108105017/#
4	D.C Motors	http://vidyamitra.inflibnet.ac.in/index.php/search?subject%5B

		%5D=Electrical&course%5B%5D=Electromagnetic+Fields&domain%5B%5D=Engineering+and+Technology
5	Single-phase transformers	https://web.digimat.in/#electrical-engineering
6	Polyphase Induction Motors	https://nptel.ac.in/courses/108/102/108102146/ https://nptel.ac.in/courses/108/105/108105131/

Text Book(s):

1. A Sudhakar and Shyam Mohan SP, "Circuits and Networks: Analysis and Synthesis", TMH, 5th Edition, New Delhi, 2015.

2. Basic Electrical Engineering –By T.K.Nagasarkar and M.S. Sukhija Oxford University Press..

Reference Book(s):

1.S.Sivanagaraju, G.Kishor&C.Srinivasa Rao, "Electrical Circuit Analysis", Cengage Learning, 1st Edition, 2010.

2. A .Chakrabarti : Circuit Theory (Analysis and Synthesis), Dhanpat Rai &Co

3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013

4. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004

5. Ravish R., Network Analysis and Synthesis, 2/e, McGraw-Hill, 2015.

Online Resources / Web Reference:

1.http://175.101.102.82/moodle/
2. https://www.accessengineeringlibrary.com/
3. https://nptel.ac.in/courses/108/105/108105066/
4.https://nptel.ac.in/courses/108/105/108105159/
5.https://nptel.ac.in/courses/108/102/108102042/
6. https://nptel.ac.in/content/storage2/courses/108105053/pdf/L-21(TB)(ET)%20((EE)NPTEL).pdf
7.https://www.researchgate.net/publication/329252017_Analysis_Study_In_Principles_Of_Operation_Of_Dc_Machine
8. https://nptel.ac.in/courses/108/102/108102146/
9. http://www.ijrimsec.com/assoc_art/volume7_1/Ch_10.pdf
10. https://www.engineering.com/
11.http://www.mathtutordvd.com/products/Engineering-Circuit-Analysis-Volume-1.cfm
12.http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-7ndelectronics-spring-2007/video-lectures/lecture-2/
13 http://www.facstaff.bucknell.edu/mastascu/elessonsHTML/Circuit/Circuit1.html

NARAYANA ENGINEERING COLLEGE:NELLORE								
20ES1007	INTRODUCTION TO PYTHON PROGRAMMING							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	2	0	0	32	2	40	60	100

Pre-requisite: Knowledge of Mathematics and Basic Programming Language

Course Objectives:

1. To learn the fundamentals of python.
2. To implement python programs for conditional loops and functions.
3. To handle the compound data using python lists, tuples, sets, dictionaries.
4. To learn the files, modules, packages concepts.
5. To introduce the concepts of class and exception handling using python.
6. To train in regular expression concepts.

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

CO 1	Summarize the fundamental concepts of python programming. (BL - 2)
CO 2	Apply the basic elements and constructs the python to solve logical problems. (BL - 3)
CO 3	Organize data using different data structures of python. (BL - 3)
CO 4	Implement the files modules and packages in programming. (BL - 3)
CO 5	Apply object oriented & exception handling concepts to build simple applications.
CO 6	Implement the concepts of Regular expressions and Turtle Graphics. (BL - 3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3												
CO2	3	2	1											
CO3	3	2												
CO4	3	1	1											
CO5	3	2												
CO6	3	1		1										

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	INTRODUCTION TO PYTHON	5h

Introduction: History of Python, Features of Python Programming, Applications of PythonProgramming, Running Python Scripts, Comments, Typed Language, Identifiers, Variables, Keywords, Input/output, Indentation, Datatypes, Type Checking, range( ), format( ), Math module.

At the end of the Module 1, students will be able to:

1. Learn the basics of python. (BL - 1)
2. Write the python programs. (BL - 1)
3. Understand concept of type checking. (BL - 2)

MODULE -2	OPERATORS EXPRESSIONS AND FUNCTIONS	5 h

Operators and Expressions: Arithmetic, Assignment, Relational, Logical, Boolean, Bitwise, Membership, Identity, Expressions and Order of Evaluations, Control Statements.

Functions: Introduction, Defining Functions, Calling Functions, Anonymous Function, Fruitful Functions and Void Functions, Parameters and Arguments, Passing Arguments, Types of Arguments, Scope of variables, Recursive Functions.

At the end of the Module 2, students will be able to:

1. Solve the problems using operators, conditional and looping. (BL - 3)
2. Solve the problems using the functions. (BL -3)
3. Apply the principle of recursion to solve the problems. (BL-3)

MODULE-3	STRINGS, LISTS,TUPLES, AND DICTIONARIES	6h

Strings, Lists, Tuples, and Dictionaries: Strings-Operations, Slicing, Methods, List-Operations, slicing, Methods, Tuple- Operations, Methods, Dictionaries- Operations, Methods, Mutable Vs Immutable, Arrays Vs Lists, Map, Reduce, Filter, Comprehensions.

At the end of the Module 3, students will be able to:

1. Write programs for manipulating the strings. (BL - 1)
2. Understand the knowledge of data structures like Tuples, Lists, and Dictionaries.(BL - 2)
3. Select appropriate data structure of Python for solving a problem.(BL -3)

MODULE-4	FILES, MODULES AND PACKAGES	6h

Files, Modules and Packages: Files- Persistent, Text Files, Reading and Writing Files, Format Operator, Filename and Paths, Command Line Arguments, File methods, Modules- Creating Modules, Import Statement, Form.Import Statement, namespacing, Packages- Introduction to PIP, Installing Packages via PIP(Numpy).

At the end of the Module 4, students will be able to:

1. Understand the concepts of files. (BL - 2)
2. Implement the modules and packages. (BL - 3)
3. Organize data in the form of files.(BL - 3)

MODULE-5	OBJECT ORIENTED PROGRAMMING, ERRORS AND EXCEPTIONS	5h

OOP in Python: Object Oriented Features, Classes, self variable, Methods, Constructors, Destructors, Inheritance, Overriding Methods, Data hiding, Polymorphism.

Error and Exceptions: Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions.

At the end of the Module 5, students will be able to:

1. Apply object orientation concepts.(BL -3)
2. Apply the exception handling concepts. (BL -3)
3. Implement OOPs using Python for solving real-world problems.(BL -3)

MODULE-6	TURTLE GRAPHICS	5h

Turtle Graphics: Move and Draw, Turtle Operations, Turtle object, Simple Graphics, The Vagrant, The Beautiful Patterns, Drawing with Colors.

At the end of the Module 6, students will be able to:

1. Understand the concepts of Turtle Graphics. (BL -2)
2. Develop GUI applications using Python. (BL -3)

Total hours:	**48Hours**

Content Beyond Syllabus: Testing, GUI Programming, Matplotlib, Databases.

Self-Study:

Contents to promote self-Learning:

SNo	Module	Reference
1	Introduction to Python	https://www.youtube.com/watch?v=WvhQhj4n6b8
		https://www.youtube.com/results?search_query=History+of+Python%2C+Features+of+Python+Programming%2C+Applications+of+Python+Programming%2C+Running+Python+Scripts%2C+Comments+in+edureka
		https://www.youtube.com/watch?v=9F6zAuYtuFw
		https://www.youtube.com/watch?v=yHFcNNh-SsA

		https://www.youtube.com/watch?v=FuPHs7GLxq8
		https://www.youtube.com/watch?v=6yrsX752CWk
		https://nptel.ac.in/courses/106/106/106106145/ [Lec - 27 &30]
		https://www.youtube.com/watch?v=0Hp7AThTZhQ
		https://www.youtube.com/watch?v=fy10ci10R_g
		https://nptel.ac.in/courses/106/106/106106145/ [Lec - 11]
		https://nptel.ac.in/courses/106/106/106106145/ [Lec - 5]
2	Operators, Expressions and Functions	https://www.youtube.com/watch?v=Pm9FOpOwhlA&t=143s
		https://nptel.ac.in/courses/106/106/106106145/ [Lec - 9]
		https://www.youtube.com/watch?v=oSPMmeaiQ68&t=51s
		https://nptel.ac.in/courses/106/106/106106145/ [Lec - 24]
3	Strings, Lists,Tuples,and Dictionaries	https://nptel.ac.in/courses/106/106/106106145/ [Lec - 6]
		https://nptel.ac.in/courses/106/106/106106145/ [Lec - 7, 12 &23]
		https://www.youtube.com/watch?v=MEPlLAjPvXY
4	Files, Modules and Packages	https://nptel.ac.in/courses/106/106/106106145/ [Lec - 28]
5	Object Oriented Programming, Errors and Exceptions	https://nptel.ac.in/courses/106/106/106106145/ [Lec - 26, 37 &38]
6	Turtle Graphics	https://www.youtube.com/watch?v=WQlKPdKVXfw
		https://www.youtube.com/playlist?list=PLzgPDYo_3xumT2sfELR4_YV3aojaxkUC9

Text Book(s):

1. VamsiKurama, Python Programming: A Modern Approach, Pearson, 2017.
2. Allen Downey, Think Python, 2ndEdition,Green Tea Press

Reference Books :

1. R. Nageswara Rao, “Core Python Programming”, 2nd edition, Dreamtech Press, 2019.
2. Allen B. Downey, “Think Python”, 2ndEdition, SPD/O’Reilly, 2016.
3. Martin C.Brown, “The Complete Reference: Python”, McGraw-Hill, 2018.
4. Mark Lutz, Learning Python, 5th Edition, Orielly, 2013.
5. Wesley J Chun, Core Python Programming, 2nd Edition, Pearson, 2007
6. Kenneth A. Lambert, Fundamentals of Python, 1st Edition, Cengage Learning, 2015

Online Resources / Web Resources:

1. https://www.datacamp.com/learn-python-with-anaconda/
2. https://www.codecademy.com/learn/paths/data-science?
3. https://www.coursera.org/courses?query=python
4. https://www.edx.org/learn/python
5. https://training.crbtech.in/neo/online-it-training-programme.php?
6. https://www.tutorialspoint.com/python/index.htm
7. https://www.w3schools.com/python/
8. https://www.javatpoint.com/python-tutorial
9. https://www.geeksforgeeks.org/python-programming-language/
10. https://www.learnpython.org/
11. https://docs.python.org/3/

NARAYANA ENGINEERING COLLEGE:NELLORE								
20CH1501	CHEMISTRY LAB (COMMON TO ECE,EEE&CSE)							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	0	0	3	48	1.5	40	60	100
Pre-requisite: Nil								
Course Objectives: Theobjectiveofthelaboratorysessionsistoenablethelearnerstogethands-onexperienceontheprinciples discussed in theory sessions and to understand the applications of these concepts inengineering.								
Course Outcomes: After successful completion of the course, the student will be able to:								
CO 1	Demonstrate the cell constant and conductance of solutions (BL2)							
CO 2	Interpret the strength of an acid present in secondary batteries (BL2)							
CO 3	Demonstrate advanced polymer materials are used in engineering applications (BL2)							

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2				2								
CO2	3	2				2								
CO3	3	2				2								
1: Low, 2-Medium, 3- High														

COURSE CONTENT	**CO**
Task-1 : Conductometrictitration of (i) strong acid vs. strong base, (ii) weak acid vs. strongbase	
Objective 1.perform a conductometric titration of a mixture of strong acid and weak acid with a strong base, 2. determine the equivalence point of the titration by plotting titration curve using conductance values and amount of the base added during titration, 3. state the advantages conductometric titrations,	CO2
Task-2 : Determination of cell constant and conductance ofsolutions	
Objective: 1. To determine conductivity of the given water sample. by using conductivity meter 2. To understand the specific conductance.	CO 1
Task-3- Verify Lambert-Beer'slaw	
Objective:1.To use spectroscopy to relate the absorbance of a colored solution to its concentration. 2.Toprepare a Beer's Law Plot to determine the concentration of an unknown.	CO 2
Task-4: pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strongbase	
Objective: 1. To perform a potentiometric titration of an acidic solution of known molarity. 2. To graph the volume of base added vs the pH and to determine the equivalence point 3. To calculate the molarity of the basic solution	CO 2
Task-5: Estimation of Ferrous Iron byDichrometry.	
Objective: 1. determine the percentage of ferrous iron in an unknown sample by redox titration with	CO 3

potassium dichromate solution . 2.The student will pre-treat the sample to obtain the iron in the reduced(+2 oxidation) state**.** 3.The student will use a solution of primary standard as the titrant	
Task-6 : Potentiometry - determination of redox potentials andemfs	
Objective: 1. Determine the concentration of an unknown iron(II) solution. By using potentiometer 2. Discuss how the potential changes with relative concentration of oxidised/reduced from, 3. perform a redox titration of ammonium iron (II) sulphate using potassium dichromate as oxidizing agent, 4. determine the equivalence point of the redox titration by plotting titration curve using potential change values and amount of oxidizing agent added during titration,	CO 3
Task-7 : Preparation of apolymer	
Objective: To prepare phenol formaldehyde resin. (Bakelite) 1. Understand the differences between linear and cross linked polymers. 2. Compare and contrast the recycling properties of linear and cross linked polymers. 3. Compare the combustion properties of various types of material. 4. Define the following terms: polymer, monomer, repeat unit, cross linking, biopolymer	CO 4
Task-8: Thin layerchromatography	
Objective: 1.To separate spinach pigments using thin layer chromate graphy 2.To describe the method of chromatography and its applications	CO 2
Task-9: Identification of simple organic compounds by IR	
Objective: 1.To learn various function groups encountered in organic chemistry 2.To learn important roll of IR spectroscopy in the study of structure of organic compounds 3.To develop skill in the recognition of characteristic absorption bands 4.to identify compound by an investigation of its IR spectrum	CO 3
Task-10 : Determination of Strength of an acid in Pb-Acidbattery	
Objective: 1.To determine the half –reactions involved in spontaneous oxidation –reduction reactions. 2. Explain the function of the lead storage and dry cell batteries …electrolysis involving two lead strips immersed in sulfuric acid.	CO 4

Additional Experiments:	
Task-11 : Measurement of 10Dq by spectrophotometricmethod	
Objective **1.** The purpose of the experiment is three-fold. First, the student verifies that the spectrochemical series **2.** based on this model are generally in poor agreement with experimental values obtained from visible spectra (3). However, because of the octahedral symmetry it is true that the splitting of the d levels predicted by crystal field theory is qualitatively correct.	CO 4
Task-12 : Models of potential energysurfaces	
Objective: 1. Distinguish between potential energies and potential energy surfaces (PESs). 2.Identify the saddle point, the reactant and product valleys and plateaus on the contour diagram of PESs 3. Distinguish between attractive and repulsive potential energy surfaces.	CO4
Virtual Labs: 1. http://vlab.amrita.edu/?sub=2&brch=190&sim=338&cnt=1 2. http://vlab.amrita.edu/?sub=2&brch=190&sim=339&cnt=1	

3. http://vlab.amrita.edu/?sub=2&brch=190&sim=606&cnt=1

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Estimation of Ferrous Iron byDichrometry.	CO 1	https://www.youtube.com/watch?v=LxgZsMhuyNM
2	Paper chromatography	CO 1	https://www.youtube.com/watch?v=NsI9vJMphKk
	Preparation of polymer	CO 4	https://www.youtube.com/watch?v=PSSK5VGcC_0

Text Book(s):

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.
2. Jain & Jain. Engineering Chemistry: Dhanapathrai Publications.,2015.
3. S.S.Dara, Experiments and Calculations in Engineering Chemistry: S-Chand Publications, Revised edition,2008.

Reference Book(s):

1. S.K. Bhasin and Sudha Rani, "Laboratory Manual on EngineeringChemistry", Dhanpat Rai Publishing Company, New Delhi, 2nd edition.
2. Sunitha Rattan, "Experiments in Applied Chemistry", S.K. Kataria&Sons,New Delhi, 2nd edition.

Web References:

1. https://nptel.ac.in/courses/122101001/23
2. https://nptel.ac.in/courses/104103071/39

NARAYANA ENGINEERING COLLEGE:NELLORE								
20ES1509	BASIC ELECTRICAL ENGINEERING LAB							R2020
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	0	0	2	32	1	40	60	100

Pre-requisite: Basic knowledge of Electrical circuits and Machines

Course Objectives:

1. To Verification of KCL, KVL and Superposition theorem.
2. To conduct testing on DC and AC Machines.

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

CO 1	Solve the electrical circuit source resistance, currents, voltage and power by applying various network reduction techniques.
CO 2	Apply various network theorems to reduce complex network into simple equivalent network with DC excitation.
CO 3	Examine the alternating quantities for different periodic wave forms and the impedance of series RC, RL and RLC circuits.

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2						3	2				
CO2	3	2	3						2	3				
CO3	3	3	2						2	2				

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
PART-A	
Task 1 - Verification of Kirchhoff laws.	
Objectives: a) To Verify the KCL b) To Verify the KVL	CO 1
Task -2 Determine Real and Reactive power for a given RLC circuits	
Objectives: a) To find Real and Reactive power for a given RLC circuits	CO 1
Task-3 Brake test on DC shunt motor. Determination of performance curves.	
Objectives:Plot the following characteristics i) Efficiency Vs Output ii) Line current Vs Output iii) Speed Vs Output iv) Torque Vs Output v) Line current Vs Torque	CO 3
Task-4 Speed Control of DC shunt motor.	
Objectives:Plot the following characteristics i) To Control the speed of DC Motor by Armature Control Method. ii) To Control the speed of DC Motor by Field Control Method.	CO 2
Task-5 O.C. & S.C. Tests on Single phase Transformer.	
Objectives: Predetermination of the following a) Efficiency at different load conditions and different power factors b) Regulation at different load conditions and different power factors c) Output vs. Efficiency curves	CO 4

Task 6 - Brake Test on Three Phase Induction Motor.	
Objectives: To determine the performance characteristics, a) Efficiency Vs Output b) Line current Vs Output c) Speed Vs Output d) Torque Vs Output	CO 3
Task 7 - Measurement of current in various branches and verify by calculation. Drawing of phasor diagram.	
Objectives: To verify the series and parallel RLC circuits	CO 1
Task 8-Magnetization characteristics of DC shunt generator. Determination of critical field resistance and critical speed	
Objectives: a) Predetermine the OCC at different speeds b) Determine the critical field resistance c) Obtain critical speed for a given shunt field resistance	CO 3
Task 9-Swinburne's test on Dc machine	
Objectives: To determine the Efficiency of DC motor and Generator	CO 3
Task 10 -Load test on DC shunt generator. Determination of characteristics.	
Objectives: a) Determine the external & internal characteristics b) Deduce the armature reaction curve	CO 3
Task 11 - Simulation of DC Circuits	
Objectives: To simulate a simple DC circuits using PSpice	CO 2
Task 12 -Mesh and Nodal Analysis	
Objectives: To simulate a simple DC circuits using PSpice	CO 2

Virtual Labs:

1. Speed Control of DC Motor By Varying The Armature And Field Resistances.
2. Conduct OC and SC Test on Single Phase Transformer.
3. Conduct Brake test on 3-phase induction motor.

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Kirchoff's Laws & Superposition theorem.	CO1	https://www.youtube.com/watch?v=S-bbn0ZQ7is
2	simple DC circuits using Pspice	CO2	https://www.csun.edu/~skatz/pspice_tutorials/pspice_tutorial_1.pdf
3	The performance characteristics of DC motors.	CO3	https://www.youtube.com/watch?v=kOj8dA9cKXo
4	The performance characteristics of AC motors.	CO4	https://www.youtube.com/watch?v=CaSdKCwlSLE

Text Book(s):

1. Basic Electrical and Electronics Engineering, M.S.Sukhija, T.K.Nagsarkar, Oxford University.
2. Basic Electrical and Electronics Engineering, S.K Bhattacharya, Pearson Education, 2012

Web Resources:

1. https://nptel.ac.in/content/storage2/courses/108105053/pdf/L-41(TB)(ET)%20((EE)NPTEL).pdf
2. https://nptel.ac.in/courses/108/102/108102146/

NARAYANA ENGINEERING COLLEGE:NELLORE								
20ES1504	ENGINEERING GRAPHICS LAB							R2020
Semester	Hours / Week			Total hrs	Credits	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	0	1	4	80	3	40	60	100

Pre-Requisite: Basic Mathematics (Geometry)

Course Objectives:

1. To impart skills on using drawing instruments
2. To convey exact and complete information of any physical object.
3. To Construct Engineering Curves.
4. To Learn and practice basic Auto CAD commands.
5. To Instruct the utility of drafting & modelling packages in orthographic and isometric drawings
6. To understand the applications of AUTOCAD for modeling physical objects

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

CO1	Develop the orthographic projection of points and straight lines(BL-3)
CO2	Construct the planes and simple solids.(BL-3).
CO3	Understand and practice basic AUTOCAD commands (BL-2)
CO4	Construct Isometric views using AUTOCAD (BL-3).

CO-PO Mapping														
CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2			1							2		
CO2	2	2			2	1						2		
CO3	1	1	1		1							1		
CO4	2	2	2		2							1		
1:Low,2-Medium,3-High														

COURSE CONTENT		
Part-A Manual Drawing		
TASK– 1	**Introduction and Conic sections**	10h
Introduction to Engineering graphics: Principles of Engineering Graphics and their significance; various instruments used, drawing sheet sizes and title block, lettering, BIS conventions, types of lines and dimensioning methods. Geometrical constructions: simple constructions, construction of Pentagon, Hexagon by general method only.		
Conic Sections: Types of conics: Ellipse, Parabola and Hyperbola (Eccentricity method only),		
At the end of the **TASK-** 1, students will be able to: 1. Understand of Geometrical Constructions.(BL-2) **2.** Draw Conic Sections by using eccentricity method.(BL-3)		
TASK–-2	**Orthographic Projections**	11h
Objectives and Principle of projection, Methods of projections, Comparison between first angle and third angle projection. **Projections of points:** Projection of points placed in different quadrants, **Projection of straight lines: F**undamental concepts**,** Line parallel, perpendicular and inclined to one and two reference planes placed in first quadrant only, **Projections of planes:** Projection of planes (Triangle, Square, Pentagon, Circle) parallel, perpendicular and inclined to one and two reference planes placed in first quadrant only		
At the end of the **TASK-** 2, students will be able to: 1. Understand Orthographic Projection of points.(BL-2) 2. Draw Projection of lines inclined to one and two reference planes.(BL-3) **3.** construct the Projection of planes inclined to one and two reference planes.(BL-3)		
TASK–3	**Projections of Solids**	13 h
Types of solids; Polyhedra, Solids of revolution, **Projections of regular solids**(Prisms, Pyramids, Cylinders and Cone),with its axis perpendicular to one plane and parallel to other plane, Axis inclined to one plane and parallel to other plane.		
At the end of the **TASK-**3, students will be able to: 1. Understand Projections of regular Solids.(BL-2) **2.** Draw projections of Prisms, Pyramids, Cylinders And Cones(BL-3)		
TASK–4	**Isometric and Orthographic views**	11h
Isometric Projections : Principles, Isometric scale, Isometric views, Conventions, Isometric views of lines, planes, simple solids (Cube, Cylinder, Cone), Conversion of Isometric views to Orthographic views.		
At the end of the **TASK**-4, students will be able to: 1.Understand Principles of Isometric Projections and Isometric scale..(BL-2)2.Draw isometric views of simple solids(BL-2) 3.Apply the principles in Conversion of Isometric views into Orthographic views.(BL-3)		
Part B Computer Aided Drafting		
TASK–5	**Introduction to AutoCAD**	16 h
Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions. Dimensioning principles and conventional representations.		
At the end of the **TASK-** 5, students will be able to: 1. Understand the Basic Auto CAD commands.(BL-2) 2. Draw the templates of simple physical objects.(BL-3) 3. Apply the utility of drafting & modelling packages in orthographic and isometric drawings		

TASK–6	Orthographic and Isometric Projections	19 h

Transformation of Isometric Projections into orthographic projections such as simple solids such as cylinder, cone, square prism, pentagonal pyramid

Draw 3D model of mechanical components such as Stepped block, Bush bearing,

Attheendofthe**TASK**-6,studentswillbeableto:

1. Developtheusageof2Dand 3Dmodelling.(BL-3)
2. Create the various views of machines components.(BL-3)

Total H: 80 hours

Content beyond syllabus:

1.Developmentofsurfaces, Section of solids

Text Book(s):

1. Bhatt N.D. "Elementary Engineering Drawing", CharotarPublishers,2014.
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education,2009
3. K.L.Narayana&P.Kannaiah,EngineeringDrawing,3/e,ScitechPublishers,Chenna i, 2012.
4. Engineering Drawing by Dr AVS Sridhar Kumar, Dr Krishnaiah , T P Vara Prasad. ,Spectrum education, Sun techno Publications,2019

Reference Book(s):

1. Engineering Drawing and Graphic Technology -International Edition, Thomas E.French, Charles J. Vierck, Robert J. Foster, McGraw-Hill, 2014
2. Venugopal.K "Engineering Drawing and Graphics", New Age International (P) Ltd., New Delhi, 2010.

Online Resources:

1. www.nptel.ac.in/courses/112104019/
2. www.nptel.ac.in/courses/105104148/
3. www.vlab.co.in

Web Resources:

1. https://mrcet.com/downloads/hs/Engineering%20Graphics%20Manual%20final.pdf
2. http://cbseacademic.nic.in/web_material/CurriculumMain21/SrSecondary/Engineering_Graphics_Sr.Sec_2020-21.pdf
3. http://cbseacademic.nic.in/web_material/Curriculum19/Main-/11_Engineering_Graphics.pdf

NARAYANA ENGINEERING COLLEGE:NELLORE								
20ES1510	**INTRODUCTION TO PYTHON PROGRAMMING LAB**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	0	0	2	32	1	40	60	100

Pre-requisite: Programming Knowledge

Course Objectives:

1. To gain knowledge on python programs basics
2. To prepare students for solving the programs on functions, data structures, Files
3. To prepare students for solving the programs on Classes, Exception Handiling, Regular Expressions and Multi threading

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

CO1	Understanding and use of python- Basic Concepts (BL -2)
CO2	Solve the concepts of python functions and data structures (BL -3)
CO3	Understand the concepts of files, modules, multithreading and regular

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3											
CO2	2	2	3											
CO3	2	2	3	3										

1-Low, 2-Medium, 3- High

COURSE CONTENT	CO
Task-1 - Python Basics	
1. Running instructions in Interactive interpreter and a Python Script 2. Write a program to purposefully raise Indentation Error and Correct it 3. Write a program to compute distance between two points taking input from the user (Pythagorean Theorem) 4. Write a program to convert a Binary number to Decimal number and verify if it is a Perfect number.	CO 1
Task-2 - Conditional Statements	
1. Write a program to determine if a given string is a Palindrome or not 2. Write a program for Fibonacci sequence is generated by adding the previous two terms by starting with 1 and 2, the first 10 terms will be: 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...	CO 1
Task-3 - Functions	
1. Write a function ball_collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding. Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius. If (distance between two balls centers) <= (sum of their radii) then (they are colliding)	CO 2
TASK-4 - Functions Continued	
1. Write a function that draws a Pyramid with # symbols # # # # # # # # # # # # # # # #	CO 2

2. Choose any five built-in string functions of C language. Implement them on your own in Python. You should not use string related Python built-in functions.	
TASK-5 - Strings	
1. Write a program to use split and join methods in the string and trace a birthday with Diction b array data structure. 2. Write a program using map, filter and reduce functions	CO 2
TASK-6 - Lists	
1. Write program which performs the following operations on list's. Don't use built-in functions a) Updating elements of a list b) Concatenation of list's c) Check for member in the list d) Insert into the list e) Sum the elements of the list f) Push and pop element of list g) Sorting of list h) Finding biggest and smallest elements in the list i) Finding common elements in the list	CO 2
TASK-7 - Files (	
1. Write a program to print each line of a file and count the number of characters, words and lines in a file. 2. Write a program that allows you to replace words, insert words and delete words from the file.	CO 3
TASK-8 - Modules and Packages	
1. Write a program for creating a module and import a module 2. Write a program to perform any two operations using Numpy	CO 3
TASK-9-Class and Objects	
1. Write a program for Class variables and instance variable and illustration of the self variable i) Robot ii) ATM Machine	CO 4
TASK-10 - Exception Handiling	
1. Write a program of exception handling to open a file while do not have write permissions 2. Write a Programto handle multiple errors with one except statement.	CO 4
TASK-11- Regular Expressions	
1. Write a Python program to remove the parenthesis area in a string. Sample data : ["example (.com)", "w3resource", "github (.com)", "stackoverflow (.com)"] 2. Write a program to match the name phone , emails, passwords and phone numbers using pattern matching	CO 3
TASK-12-Turtle	
1. Write a turtle program to construct a clock dial 2. Write a turtle program to produce a flower in different colours	CO 3

Additional Experiments	
TASK-1	
1. Write a python program to find the resolution of an image 2. Write a python program to count the number of vowels and consonants	

3. Write a python program to print the ASCII value of acharacter	

NARAYANA ENGINEERING COLLEGE: NELLORE

Virtual Labs:	
Python Lab (IIT Bombay) :http://vlabs.iitb.ac.in/vlabs-dev/labs/python-basics/experimentlist.html	
List of Experiments	
1. Arithmetic Operations 2. Built-in Functions 3. Loops 4. Data Types 5. Strings	6. Classes and Objects 7. Built-in Modules 8. Constructors and Inheritance 9. File Operators

Text Book(s):

1. VamsiKurama, Python Programming: A Modern Approach, Pearson, 2017.
2. Allen Downey, Think Python, 2ndEdition,Green Tea Press

Reference Books :

1. R. Nageswara Rao, "Core Python Programming", 2nd edition, Dreamtech Press, 2019.
2. Allen B. Downey, "Think Python", 2ndEdition, SPD/O'Reilly, 2016.
3. Martin C.Brown, "The Complete Reference: Python", McGraw-Hill, 2018.
4. Mark Lutz, Learning Python, 5th Edition, Orielly, 2013.
5. Wesley J Chun, Core Python Programming, 2nd Edition, Pearson, 2007
6. Kenneth A. Lambert, Fundamentals of Python, 1st Edition, Cengage Learning, 2015

Web References:

1. https://www.tutorialspoint.com/python/index.htm
2. https://www.w3schools.com/python/
3. https://www.javatpoint.com/python-tutorial
4. https://www.geeksforgeeks.org/python-programming-language/

20EN1502	ORAL COMMUNICATION SKILLS LAB							
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
II	0	0	2	32	1	40	60	100

Task – 1: Introducing to others

Situational Dialogues, Ice - Breaking Activity, Introducing Oneself and Others – Greetings – Taking Leave, Think pair share, Oral Description of Pictures, Photographs, Products, and Process

Task – 2: Debate

What is Debate, How to Debate, Tips for Debate, Debate Practice, Explanation of Debate Techniques, Debate Videos Presentation

Task – 3: Group Discussion

What is Group Discussion, Types of Group Discussion, Tips and Techniques for Effective Group Discussion, Group Discussion Videos Presentation.

Task – 4: Professional Skills

Telephone Etiquette, Making an Appointment, Telephone Talk and Tips, Effective E-mail Resume Writing, Resume Cover Letter, Curriculum Vitae Preparation

Task – 5: Presentation Skills

Oral presentations (individual and group) through Seminars / PPTs, Importance of Body Language, Paper Presentation, Public Speaking Tips, Effective Presentation of renowned speakers.

Task – 6: Interview Skills

Interview Skills Introduction, Interview strategies, Interview questions, Successful Interview presentations and Mock Interviews.

Reference Books:

1. Rizvi, Ashraf. M., Effective Technical Communication, Mc Graw Hill, New Delhi. 2005
2. Raman, Meenakshi& Sangeetha Sharma. Technical Communication: Principles and Practice, Oxford University Press, New Delhi. 2011.
3. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
4. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata McGraw-Hill 2009
5. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009

NARAYANA ENGINEERING COLLEGE: NELLORE								
20MA1005	COMPLEX ANALYSIS & NUMERICAL METHODS							R-20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
I	3	0	0	48	3	40	60	100

Pre-requisite: inter mathematics

Course Objectives: This course aims to providing the knowledge for the student about on

1. Special functions and
2. Complex Variables Differentiation & Integration.
3. Various numerical methods for solving an algebraic and transcendental equations,
4. To interpolating the values through the polynomials,
5. To evaluation of integral values through the numerical methods
6. To solve ordinary differential equations through the numerical methods.

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

CO 1	Apply the techniques of special functions in various engineering problems . (BL-3)
CO 2	Identify the analyticity of complex functions to find the derivatives of complex functions. (BL-2)
CO 3	Apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper integrals along contours. (BL-3)
CO 4	Solve the Algebraic ,Transcendental Equations by using numerical methods & understand the concepts of Interpolation . (BL-3)
CO 5	Solve the ordinary differential equations by using various numerical methods. (BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3												
CO2	3	3											1	
CO3	3	3											1	
CO4	3	3												
CO5	3	3											1	

1- Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	Special Functions	Hours:10

Introduction to special functions, Beta function- Definition of beta function and its properties (with proof), Other forms of Beta function (with proof), Gamma function- Definition of Gamma function and its properties (with proof), Relation between Beta and Gamma functions (with proof)

At the end of the Module 1, students will be able to:

1. Understand Beta and Gamma functions and its relations. (L-3)
2. Explain the applications and the usefulness of these special functions. (L-2)
3. Use Beta & Gamma functions to evaluate different types of integral problems (L-1)
4. Apply the techniques of special functions in various engineering problems. (L-3)

MODULE -2	Complex variables – Differentiation	Hours:10

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate-construction of analytic function by Milne -Thomson method.

At the end of the Module 2, students will be able to:

1. Understand functions of Complex variable and its properties. (L-3)
2. Evaluate derivatives of complex functions. (L-5)
3. Understand the analyticity of complex functions. (L-3)

MODULE-3	Complex Variables – Integration	Hours:8

Line integral-Contour integration, Cauchy's integral theorem (without proof), Cauchy's Integral formula (without proof), zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals (around unit circle, semi-circle with

At the end of the Module 3, students will be able to:

1. Understand the integration of complex functions. (L-3)
2. Apply Cauchy's integral theorem and Cauchy's integral formula. (L-3)
3. Understand singularities of complex functions. (L-3)
4. Evaluate improper integrals of complex functions using Residue theorem. (L-5)

MODULE-4	Solution of Algebraic, Transcendental Equations & Interpolation	Hours:10

Introduction-Bisection method, Regula-falsi method, Newton Raphson method, Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae.

At the end of the Module 4, students will be able to:

1. Solve an algebraic or transcendental equation using an appropriate numerical method. (L-3)
2. Understand the use of different operators in interpolation. (L-2)
3. Find interpolating polynomials using Newton's forward and backward formulae. (L-2)
4. Understand the theoretical and practical aspects of the use of numerical methods. (L-2)

MODULE-5	Numerical integration & Solution of ordinary differential equations	Hours:10

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method- Runge-Kutta Method.

At the end of the Module 5, students will be able to:

1. Apply numerical differentiation and integration techniques to various engineering problems. (L-3)
2. Understand the techniques of Trapezoidal rule, Simpson's 1/3 Rule, Simpson's 3/8 Rule and its applications (L-2)
3. Work out numerical differentiation whenever and wherever routine methods are not (L-1)
4. Apply Runge-kutta method in engineering problems (L-3)

Total hours	**48**

Content beyond syllabus:

1. Central difference interpolation.
2. Iteration Methods.

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Special Functions	**CO1**	https://youtu.be/Zp05KlxaRcY
2	Complex Variables Differentiation	**CO2**	https://youtu.be/t9xW7UaZwZ0 https://youtu.be/59u4PnalRCc
3	Complex Variables integration	**CO3**	https://youtu.be/OQQqbV32b78
4	Solution of Algebraic and Transcendental Equations	**CO4**	https://www.youtube.com/watch?v=apuEXUAntJo
5	Numerical Differentiation & Integration	**CO5**	https://www.youtube.com/watch?v=0rtaUUonwkU
6	Numerical solution of Ordinary differential equations	**CO6**	https://www.youtube.com/watch?v=QugqSa3Gl-w

Text Book(s):

1. B.S. Grewal, "Higher Engineering Mathematics", 44th edition ,Khanna Publishers,2017.
2. 2 Ramana B.V., "Higher Engineering Mathematics", McGraw Hill Publishers,2017..
3. 3. S.S. SASTRY, Introductory Methods of Numerical Analysis, 5/e, PHI learning private limited, 2012.

Reference Book(s):

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley.
2. Veerarajan T., "Engineering Mathematics", Tata McGraw-Hill.
3. Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018
4. R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.

Online Resources/ Web References:

1. http://www.faadooengineers.com/threads/13449-Engineering-Maths-II-eBooks.
2. http://www.math.ust.hk/~machas/numerical-methods.pdf
3. http://www.efunda.com/math/math_home/math.cfm
4. http://www.ocw.mit.edu/resources/#Mathematics
5. http://www.sosmath.com
6. http://www.mathworld.wolfram.com
7. https://global.oup.com/uk/orc/biosciences/maths/reed/01student/numerical_tutorials

NARAYANA ENGINEERING COLLEGE:NELLORE								
20ES1010	**DATA STRUCTURES**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	2	0	2	32	3	40	60	100

Pre-requisite: Knowledge of Mathematics, Computer Programming, Analytical & Logical Skills

Course Objectives:

1. To explain efficient storage mechanisms of data for an easy access.
2. To design and implementation of various basic and advanced data structures.
3. To introduce various techniques for representation of the data in the real world.
4. To develop applications using data structures.
5. To pertain knowledge on improving the efficiency of algorithm by using suitable data structure.

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

CO 1	Classify the Data Structures concepts in real time applications. (BL-2).
CO 2	Demonstrate the concepts of stacks and queues for organizing data. (BL-3).
CO 3	Demonstrate the concepts of Linked Lists in Linear Data Structures. (BL-3).
CO 4	Interpret different ways of handling Trees and Graphs as non-linear Data Structures (BL-3).
CO 5	Analyze different searching and sorting techniques for organizing data (BL-4).

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO 1	3	2	2										2	
CO 2	1	3	3										2	
CO 3	1	3	3	1									1	
CO 4	1	3	2	1									1	
CO 5	2	3	3	1									2	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	**Introduction to Data Structures**	**6H**

Introduction: Overview of Data Structures, Implementation of Data Structures, Algorithm Specifications, Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.
Arrays: One-Dimensional, Multi-Dimensional, Pointer Arrays.

At the end of the Module 1, students will be able to:

1. Understand the linear and non-linear data structures. (BL - 2)
2. Understand the time and space complexities of an algorithm. (BL - 2)
3. Illustrate representation of data using Arrays. (BL - 2)

MODULE -2	**Stacks and Queues**	**7H**

Stacks: Introduction, Representation of a Stack, Stack Operations, Applications of Stacks.
Queues: Introduction, Representation of a Queue, Queue Operations, Circular Queue, Applications of Queues.

At the end of the Module 2, students will be able to:

1. Explain stack ADT and its operations. (BL - 2)
2. Understand the expression evaluation using stacks. (BL - 2)
3. Implement various queue structures. (BL - 3)

MODULE-3	Linked Lists	6H

Introduction, Singly linked lists, Doubly Linked Lists, Circular Linked Lists, Linked Stacks and Queues, Applications of Linked Lists.

At the end of the Module 3, students will be able to:

1. Understand basics concepts of linked lists. (BL - 2)
2. Illustrate various structures of linked lists. (BL - 2)
3. Understand the concept of dynamic memory management. (BL - 2)

MODULE-4	Trees & Graphs	6H

Trees: Introduction, Basic Terminologies, Definition and Concepts, Representation of Binary Tree, Operations on a BinaryTree, Binary SearchTree, Height BalancedBinaryTree.
Graphs: Introduction, Graph Terminologies, Representation of Graphs, Graph Operations, Shortest Paths – Warshall's, Floyd's and Dijkstra's algorithms, Topological Sorting.

At the end of the Module 4, students will be able to:

1. Understand the concept of trees. (BL - 2)
2. Compare different tree structures. (BL - 2)
3. Explain the importance of Graphs for solving problems. (BL - 2)
4. Understand graph traversal methods. (BL - 2)
5. Implement algorithms to identify shortest path. (BL - 3)

MODULE-5	Sorting, Searching and Hash Tables	7H

Sorting: Introduction, Bubble Sort, Selection Sort, Quick Sort.
Searching: Introduction, Basic Terminology, Linear Search and Binary Search Techniques
Hash Table: Hashing Techniques, Collision Resolution Techniques, Closed Hashing, Open Hashing.

At the end of the Module 6, students will be able to:

1. Implement the sorting algorithms (BL - 3)
2. Select the appropriate sorting algorithm for a given application (BL - 3)
3. Understand the concept of Hash Table (BL - 2)
4. Explain searching techniques. (BL - 2)

Total hours:	**32 hours**

Content beyond syllabus:

1. Heap Sort, Insertion Sort, Merge Sort
2. Optimum Sorting Algorithms

Self-Study:
Contents to promote self-Learning:

SNO	Module	Reference
1	Introduction to Data Structures	https://www.youtube.com/watch?v=coxWfcz_sIk&list=PLrjkTql3jnm8ikiQIeIHrMYCaBfkBkfYR&index=1 https://www.youtube.com/watch?v=qt6gnsxevZ0&list=PLrjkTql3jnm8ikiQIeIHrMYCaBfkBkfYR&index=5

		https://www.youtube.com/watch?v=NlWEdScxU9k&list=PLrjkTql3jnm8ikiQIeIHrMYCaBfkBkfYR&index=7
2	Stacks and Queues	https://www.youtube.com/watch?v=o-B4qNnwujY&list=PLrjkTql3jnm8ikiQIeIHrMYCaBfkBkfYR&index=10 https://www.youtube.com/watch?v=UK8WaQYdcMo&list=PLrjkTql3jnm8ikiQIeIHrMYCaBfkBkfYR&index=12
3	Linked List	https://www.youtube.com/watch?v=hGxtTPPpqQs&list=PLrjkTql3jnm8ikiQIeIHrMYCaBfkBkfYR&index=22
4	Trees& Graphs	https://www.youtube.com/watch?v=e14hpagIr3U&list=PLrjkTql3jnm8ikiQIeIHrMYCaBfkBkfYR&index=26 https://www.youtube.com/watch?v=ZAU5IlCQBls&list=PLrjkTql3jnm8ikiQIeIHrMYCaBfkBkfYR&index=46
5	Sorting and Hash Tables	https://www.youtube.com/watch?v=TnU8COKcZs&list=PLrjkTql3jnm8ikiQIeIHrMYCaBfkBkfYR&index=52

Text Book(s):

1. D. Samanta, "Classic Data Structures", 2nd Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.
2. Ellis Horowitz and Sartaj Sahni, "Fundamentals of Data Structures in C", 2nd Edition, Universities Press , 2008.

Reference Books:

1. NarasimhaKarumanchi, Data Structures and Algorithms Made Easy, Careermonk Publications, 2016
2. Peter Bras, "Advanced Data Structures", Cambridge University Press, 2014.
3. RS Salaria, Data Structures, 3rd Edition, Khanna Publishing House, 2017.
4. YashwantKanetkar, Data Structures through C,3rd Edition, BPB Publications, 2019.
5. RB Patel, Expert Data Structures with C, Khanna Publications, 2019.
6. Richard F. Gilberg, Behrouz A. Forouzan, Data Structures A Pseudo code Approach with C, Second Edition, Cengage Learning.
7. Ananda Rao Akepogu, Radhika Raju Palagiri,Data Structures and Algorithms Using C++ ,

Online Resources / Web Resources:

1. https://nptel.ac.in/courses/106/102/106102064/
2. https://swayam.gov.in/nd2_cec19_cs04/preview
3. https://www.youtube.com/watch?v=0IAPZzGSbME&list=PLDN4rrl48XKpZkf03iYFl-O29szjTrs_O
4. https://www.youtube.com/watch?v=AT14lCXuMKI&list=PLdo5W4Nhv31bbKJzrsKfMpo_grxuLl8LU
5. https://www.youtube.com/watch?v=Db9ZYbJONHc&list=PLVlQHNRLflP_OxF1QJoGBwH_TnZszHR_j
6. https://www.youtube.com/watch?v=92S4zgXN17o&list=PL2_aWCzGMAwI3W_JlcBbtYTwiQSsOTa6P
7. https://www.youtube.com/playlist?list=PLrqxgoIHbaCQPHa2LnGX0f-dCIH2MWlFS
8. https://www.youtube.com/playlist?list=PLrjkTql3jnm8ikiQIeIHrMYCaBfkBkfYR
9. https://www.tutorialspoint.com/data_structures_algorithms/data_structures_basics.htm
   https://www.hackerrank.com/domains/data-structures
   https://www.cs.usfca.edu/~galles/visualization/Algorithms.html
10. https://discuss.codechef.com/t/data-structures-and-algorithms/6599
11. Algorithms Notes for Professionals book :https://books.goalkicker.com/AlgorithmsBook/

NARAYANA ENGINEERING COLLEGE:NELLORE								
20ES1012	ELECTRONIC DEVICES AND CIRCUITS							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	3	0	0	48	3	40	60	100

Pre-requisite: Semiconductor Physics.

Course Objectives:

1. To study the operation and characteristics of PN junction diode and special semiconductor devices..
2. To familiarize the design and analysis of rectifiers with filters.
3. To describe the characteristics of BJT and its configurations.
4. To analyze the biasing circuits of BJT.
5. To study the characteristics of MOSFET.

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

CO 1	Illustrate the V-I characteristics of P-N junction Diode and special semiconductor devices. (BL-2)
CO 2	Demonstrate the performance of rectifiers with and without filters. (BL-2)
CO 3	Compare the operating characteristics of BJT (BL-3)
CO 4	Analyze the BJT biasing techniques. (BL-4)
CO 5	Interpret the characteristics of MOSFET. (BL-2)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1											3	
CO2	3	2	3										3	
CO3	3	2											3	
CO4	3	3	2										2	
CO5	3	1	1										3	3

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	SEMICONDUCTOR DIODE&SPECIAL SEMICONDUCTOR DEVICES	10 Hrs

Semiconductor Diode: Principle and Structure of PN junction diode, Open circuited PN junction diode, Energy band diagram of PN diode, Diode current Equation, Volt-Ampere Characteristics, Temperature dependence of Volt-Ampere Characteristics, Diode capacitance.

Special Semiconductor Devices: Principle of operation and Characteristics of Varactor diode, Tunnel Diode, Photo diode, LED, SCR

At the end of the Module 1, student will be able to:

1.Define PN junction diode (BL-1)

2. Explain the operation of PN junction diode for both forward and reverse bias. (BL-2)

3.Explain the energy band diagram of PN junction diode (BL-2)

4. Interpret the effect of temperature on V-I characteristics of PN junction diode (BL-2)

5. Derive the expression for transition and diffusion capacitance (BL-2)
6. Explain V-I Characteristics of various special diodes. (BL-2)
7. Describe the principle of operation of thyristors. (BL-2)

MODULE -2	RECTIFIERS & FILTERS	10 Hrs

Diode applications: P-N junction diode as a rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, rectifier parameters, Harmonic components in Rectifier Circuits. Clippers and Clampers (Qualitative Treatment only)

Filters: Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters, bleeder resistor.

At the end of the Module 2, students will be able to:

1. Explain the operation of a bridge rectifier. (BL-2)
2. Analyze the performance of rectifiers with and without filters. (BL-4)
3. Design half wave and full wave rectifier circuits. (BL-4)
4. Differentiate various rectifier circuits in terms of their parameter metrics.(BL-2)
5. Explain the importance of bleeder resistor (BL-2)

MODULE-3	BIPOLAR JUNCTION TRANSISTOR	9 Hrs

Bipolar junction Transistor : Construction, Principle of Operation, transistor current components , transistor configurations, Transistor h-parameter model, calculation of h-parameters from characteristics, transistor as a switch, transistor as an amplifier.

At the end of the Module 3, students will be able to:

1. Discuss the current components and their relationships in BJT (BL-2)
2. Explain principle, operation and applications of BJT (BL-2)
3. Describe input and output Characteristics of BJT (BL-2)
4. Differentiate BJT configurations (CB,CC,CE) (BL-2)

MODULE-4	TRANSISTOR BIASING	10 Hrs

Transistor Biasing: Need for biasing, operating point, load line analysis, Stabilization against variations in I_{CO}, V_{BE} and β, biasing and stabilization techniques: fixed bias, collector to base bias, voltage divider bias, bias compensation techniques, thermal runaway, heat sink and thermal stability.

At the end of the Module 4, students will be able to:

1. Explain principle, operation and applications of MOSFET (BL-2)
2. Describe the operation and characteristics of Depletion MOSFET. (BL-2)
3. Explain the operation and characteristics of Enhancement MOSFET. (BL-2)
4. Differentiate enhancement and depletion mode MOSFET. (BL-2)

MODULE-5	METAL OXIDE SEMICONDUCTOR FIELD-EFFECT TRANSISTOR	9 Hrs

MOSFET: Construction of depletion mode and enhancement mode of NMOS and PMOS, Drain characteristics of MOSFET, Transfer Characteristics of MOSFET, MOSFET as a Switch, CMOS Inverter and it's Characteristics.

At the end of the Module 5, students will be able to:

1.Define biasing and stabilization (BL-1)
2.Explain the importance of thermal stability (BL-2)
3.Analyze the stabilization techniques.(BL-4)
4. Differentiate compensation techniques. (BL-2)

Total hours:	**48 Hours**

Content beyond syllabus:

1. Multi vibrators-Mono stable, Bi stable & Astable multi vibrators,
2. signal conditioning circuits-input signal determination, amplification, filtering.

Self-Study:

Contents to promote self-Learning:

SNO	Module	Reference
1	Semiconductor diode & Special semiconductor devices	https://www.electronics-tutorials.ws/diode/diode_3.html https://www.electrical4u.com/tunnel-diode
2	Rectifiers and filters.	https://www.electricaltechnology.org/2019/01/what-is-rectifier-types-of-rectifiers-their-operation.html
3	Bipolar junction Transistor	https://www.electronics-tutorials.ws/transistor/tran_2.html
4	Transistor Biasing	https://www.tutorialspoint.com/amplifiers/methods_of_transistor_biasing.htm
5	Field effect transistors	https://www.electronics-tutorials.ws/transistor/tran_5.html.

Text Book(s):

1. 1. J. Milliman and C Halkias, "Integrated electronics", 2nd Edition, Tata McGraw Hill, 1991.
2. L. Boylestad and Louis Nashelsky (2006), Electronic Devices and Circuits, 9th Edition, Pearson/Prentice Hall
3. Electronic Devices and Circuits by Lal Kishore, BS Publications.

Reference Book(s):

1. Behzad Razavi, "Microelectronics", Second edition, Wiley, 2013.
2. S. Salivahanan, N. Suresh Kumar, A. Vallavaraj (2008), Electronic Devices and Circuits, 2nd edition, Tata McGraw Hill, New Delhi.
3. Jimmie J Cathey, "Electronic Devices and Circuits," Schaum's outlines series, 3rd edition, McGraw-Hill (India), 2010.

Online Resources /Web References:

1.http://www.acadmix.com/eBooks_Download
2.https://www.freebookcentre.net/Electronics/Electronic-Circuits-Books.html
3. https://nptel.iitm.ac.in/courses/108/108/108108122/
4.https://www.classcentral.com/course/swayam-microelectronics-devices-to-circuits-14198
5.https://www.khanacademy.org/science/electrical-engineering
6.http://afrotechmods.com/tutorials
7.http://www.tutorialspoint.com/electronic devices

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2001	**DIGITAL LOGIC DESIGN**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge on number system and algebra.

Course Objectives:

1. To study the basic concepts of number systems and binary codes.
2. To minimize Boolean expressions using map and Q-M method.
3. To design combinational and sequential circuits.
4. To familiarize Registers &counters using Flip-Flops.
5. To understand the concept of memory organization

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

CO 1	Use number systems, binary codes and Boolean algebra to implement digital circuits. (BL-3)
CO 2	Apply minimization techniques on Boolean expressions. (BL-3)
CO 3	Design combinational circuits using logic gates. (BL-3)
CO 4	Analyze synchronous sequential circuits. (BL-4)

CO 5	Classify the memories & programmable logic devices. (BL-2)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1										1	
CO2	3	3	3	1									1	
CO3	3	3	3	1									1	1
CO4	3	1	2	1									2	1
CO5	2	2											1	1

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	NUMBER SYSTEMS & BOOLEAN ALGEBRA	10 h

Number Systems: Introduction, Number Systems, Number base conversions, 1's and 2's Complements, BCD code, Excess -3 codes, Gray code, ASCII code, Error Detection and Correction Codes. Boolean Algebra: Basic definition, Basic theorems and properties, Boolean Functions, Canonical & Standard forms, Logic gates, implementation of Boolean functions using logic gates

At the end of the Module 1, students will be able to:

1. List number systems. (BL-1)
2. Illustrate different code conversions. (BL-2)
3. List Theorem's and properties of Boolean algebra (BL-1)
4. Explain the functionality of logic gates(BL-2)

MODULE -2	SIMPLIFICATION OF BOOLEAN FUNCTIONS	10 h

Introduction, Karnaugh map simplification, Don't care conditions, Prime Implicants, Quine-McCluskey method Simplification, NAND & NOR Implementations, Two Level Implementations.

At the end of the Module 2, students will be able to:

1. Apply basic laws and De Morgan's theorems to simplify Boolean expressions(BL-3)
2. Explain map and Q-M method to minimize Boolean expressions. (BL-2)
3. Implement Boolean expression using universal gates. (BL-3)
4. Implement Boolean expression using two level methods. (BL-3)

MODULE-3	COMBINATIONAL CIRCUITS	9 h

Introduction, Design Procedure, Adders, Sub tractor, Binary Adder-Sub tractor, BCD Adder, Binary Multiplier, Magnitude Comparator, Multiplexers, De-multiplexers, Decoders, Encoders and Code Converters.

At the end of the Module 3, students will be able to:

1. Design combinational logic circuits. (BL-3)
2. Implement Boolean expression using multiplexer. (BL-3)
3. Implement higher order MUX using lower order MUX.(BL-3)
4. Design code converters using gates. (BL-3)

MODULE-4	SEQUENTIAL CIRCUITS	10 h

Introduction, Latches, Flip-flops, Master-slave flip flops, Edge-triggered flip-flops, Flip-Flop conversions, Design of Synchronous Sequential Circuits: State Equations, State Table, State reduction, State assignment, State diagram , Mealy and Moore machine models, Registers, Shift Registers, Counters: Synchronous counters, Asynchronous counters & other counters.

At the end of the Module 4, students will be able to:

1. Describe behavior of latches & flip flops. (BL-2)
2. Analyze the flip-flop conversions(BL-3)
3. Analyze synchronous sequential circuits. (BL-3)
4. Explain the design procedure of sequential circuits(BL-2)
5. Design synchronous sequential circuits using state reduction & assignment process. (BL-3)

MODULE-5	MEMORY &PROGRAMMABLE LOGIC DEVICES	9 h

Introduction, Random Access Memory, Types of RAM, Memory decoding, Read Only Memory, Types of ROM, Flash memory, Programmable Logic Devices (PLDs): Basic concepts, Programmable Read Only Memory (PROM), Programmable Array Logic (PAL) and Programmable Logic Array(PLA).

At the end of the Module 6, students will be able to:

1. Explain PROM, PAL and PLA. (BL-2)
2. Compare digital logic families. (BL-2)
3. Illustrate the characteristics of digital IC's . (BL-2)

Total hours:	**48 hours**

Content beyond syllabus:

1. Representation of signed & unsigned binary numbers in digital computer
2. Binary subtraction operation using 1's and 2's complement methods in digital circuits

Self-Study:

Contents to promote self-Learning:

SNO	Module	Reference
1	Number systems	https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
2	Simplification of Boolean functions	https://www.electrical4u.com/simplifying-boolean-expression-using-k-map/ https://www.electronicshub.org/k-map-karnaugh-map

3	Combinational circuits	https://www.allaboutcircuits.com/textbook/digital/
4	Sequential Circuits	https://www.electronics-tutorials.ws/sequential/seq_1.html https://technobyte.org/counters-up-down-synchronous-asynchronous/
5	Programmable logic devices	https://www.tutorialspoint.com/digital_circuits/digital_circuits_programmable_logic_devices.htm

Text Book(s):

1. M. Morris Mano, M.D. Ciletti, "Digital Design", 5th edition, Pearson, 2018.
2. John F Wakely Digital Design Principles And Practices, Pearson Publication , Fourth edition
3. Anil K. Maini, "Digital Electronics: Principles, Devices and Applications", Willey, 2007

Reference Book(s):

1. Anand Kumar, Switching Theory and Logic Design, PHI,2008
2. John. M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.
3. R. P. Jain, "Modern Digital Electronics", 4th edition, McGraw Hill Education (India Private Limited), 2012.

Online Resources / Web References:

1. https://nptel.ac.in/courses/108/105/108105113/ (IIT- Kharagpur – digital Circuits)
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-004-computation-structures-spring-2017/c4/
3. https://nptel.ac.in/courses/106/105/106105185/(IIT- Kharagpur – Switching Circuits and Logic Design)
4. https://www.researchgate.net/publication/264005171_Digital_Electronics
5. https://www.academia.edu/37445384/Anil_K._Maini_Digital_Electronics_Principles_01.04.16.pdf
6. https://intuitionke.weebly.com/uploads/1/1/8/2/118271274/digital_principles_switching_theory.pdf
7. https://www.javatpoint.com/digital-electronics

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2002	NETWORK THEORY							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	3	0	0	45	3	40	60	100

Pre-requisite: Fundamental of Basic Electrical circuits

Course Objectives:

1. To understand frequency response in electrical circuits
2. The capability to analyze the Low and High Pass filter.
3. Evaluate the behaviour of networks for transient analysis of first order and second order.
4. Analyze and synthesize networks using Laplace transforms.
5. Different types of two-port network analysis using network parameters, with different types of connections.

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

CO 1	Describe the Series resonance ,parallel resonance and analyze the locus diagramsof R,L,C(BL-2)
CO 2	Analyze the DC transients of R,L,C (BL-4)
CO 3	Analyze the AC transients of R,L,C (BL-4)
CO 4	Derive Two port network parameters of Electrical circuits(BL-3)
CO 5	Analyze the Filters and Network functions(BL-4)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1									1	1
CO2	3	2	2	2									1	1
CO3	3	2	2	2									1	1
CO4	3	3	2	2									1	1
CO5	3	3	2	2									1	1

COURSE CONTENT

MODULE – 1	RESONANCE	9hrs

Introduction, Definition of quality factor **Q** of inductor and capacitor, Series resonance, Bandwidth of the series resonant circuits, Parallel resonance (or anti-resonance), Locus diagram for Series R-L, R-C, R-L-C and Parallel Combination with Variation of Parameters.

At the end of the Module 1, students will be able to:

1. Explain the series and parallel resonance.(BL-2)
2. Understand the effect of resonance on series and parallel resonance circuits.(BL-2)

3. Understand the concept of locus diagrams. (BL-2)

MODULE -2	DC TRANSIENT ANALYSIS	9hrs

Transient Response of R-L, R-C, R-L-C Series and Parallel Circuits for D.C Excitation-Initial Conditions-Solution Method Using Differential Equations and Laplace Transforms, Response of R-L & R-C Networks to Pulse Excitation.

At the end of the Module 3, students will be able to:

1. Explain the transient phenomenon in DC excitations. (BL-2)
2. Explain Application of Laplace transform for solution of D.C transient circuits. (BL-2)
3. Compare the classical method and Laplace transform approach in sinusoidal excitations. (BL-2)

MODULE -3	AC TRANSIENT ANALYSIS	9hrs

Transient Response of R-L, R-C, R-L-C Series and Parallel Circuits for Sinusoidal Excitations-Initial Conditions-Solution Method Using Differential Equations and Laplace Transforms.

At the end of the Module 4, students will be able to:

1. Explain the transient phenomenon in AC excitations. (BL-2)
2. Understand AC transient analysis in electrical circuits to know the power system stability. (BL-2)
3. Develop knowledge on R-L, R-C and R-L-C circuit analysis in A.C. (BL-3)

MODULE -4	TWO PORT NETWORKS	9Hrs

Two Port Network Parameters: Impedance, Admittance, Transmission and Hybrid Parameters and their Relations, Reciprocity and Symmetry conditions, Concept of Transformed Network, Two Port Network Parameters Using Transformed Variables.

At the end of the Module 5, students will be able to:

1. Understand the concept of two port network theory. (BL-2)
2. Verify the Reciprocity and Symmetry conditions for the given two port network. (BL-1)
3. Understand the concept of Transformed Network (BL-2)

MODULE-5	FILTERS & NETWORK FUNCTIONS	9HRS

Filters – Low Pass – High Pass and Band Pass – RC, RL filters– derived filters and composite filters design – Attenuators – Network functions for one port and two port networks, pole-zeros of network functions and network stability

At the end of the Module 6, students will be able to:

1. Explain the types of filters. (BL-2)
2. Explain the parameters for the design of various filters. (BL-2)
3. Explain the poles and zeros of a given transfer function. (BL-2)

Total hours:	45 hours

Content beyond syllabus:

1. Scattering Matrix
2. Fourier method of waveform analysis

Self-Study:

Contents to promote self-Learning:

SNO	Topic	Reference
1	Resonance and locus diagram	https://www.youtube.com/watch?v=6mC0xkXsFdw

2	DC Transient analysis	https://www.youtube.com/watch?v=15d-gyoBxIQ
3	AC Transient analysis	https://www.youtube.com/watch?v=SPs5o7SzcOo
4	Two port network	https://nptel.ac.in/courses/108/102/108102042/
5	Filters& Network function	https://www.youtube.com/watch?v=u59IUA6uvjk

Text Book(s):

1. A Sudhakar and Shyam Mohan SP, "Circuits and Networks: Analysis and Synthesis", TMH, 5th Edition, New Delhi, 2015.

2. Ravish R., Network Analysis and Synthesis, 2/e, McGraw-Hill, 2015

Reference Book(s):

1. S.Sivanagaraju, G.Kishor & C.Srinivasa Rao, "Electrical Circuit Analysis", Cengage Learning, 1st Edition, 2010.

2. A. Chakrabarti : Circuit Theory (Analysis and Synthesis), Dhanpat Rai &Co

3. Joseph A. Edminister and Mahmood Nahvi, "Electric Circuits Schaum"s Outline Series", 6th Edition, Tata McGraw-Hill, 2014, New Delhi.

Online Resources / Web Reference:

1. https://nptel.ac.in/courses/108/105/108105159/
2.https://nptel.ac.in/content/storage2/courses/108105053/pdf/L-10(GDR)(ET)%20((EE)NPTEL).pdf
3.https://nptel.ac.in/content/storage2/courses/108105053/pdf/L-1(TB)(ET)%20((EE)NPTEL).pdf
4. https://en.wikibooks.org/wiki/Circuit_Theory
5. https://nptel.ac.in/content/storage2/courses/117108107/Lecture%2022.pdf
6. https://nptel.ac.in/content/storage2/courses/108101091/Week%208%20Slides.pdf
7.http://www.mathtutordvd.com/products/Engineering-Circuit-Analysis-Volume-1.cfm
8.http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-andelectronics-spring-2007/video-lectures/lecture-2/
9. http://www.facstaff.bucknell.edu/mastascu/elessonsHTML/Circuit/Circuit1.html
10. https://opencourses.emu.edu.tr/course/view.php?id=3

NARAYANA ENGINEERING COLLEGE:NELLORE								
20ES1515	**ELECTRONIC DEVICES & CIRCUITS LAB**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
III	0	0	3	36	1.5	40	60	100
Pre-requisite: Basic knowledge on semiconductor physics.								
Course Objectives: 1. To Gain Knowledge on basic electronic devices. 2. To Observe the characteristics of various electronic devices. 3. To prepare students for designing various biasing circuits								
Course Outcomes: After successful completion of the course, the student will be able to:								
CO 1	Demonstrate the V-I characteristics of PN junction diode, Zener Diode and LED.							
CO 2	Design various rectifiers with filters for a given specifications							
CO 3	Analyze the DC Characteristics of BJT and MOSFET							

CO-PO Mapping													
CO	**PO**											**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	2						3	2		2	2	2
CO2	3	1	2						3	2		2	2	2
CO3	3	1	1						3	2		2	2	2
1: Low, 2-Medium, 3- High														

COURSE CONTENT	CO
Task-1: PN Junction Diode	
Objective: To Verify the Volt- Ampere characteristics of a PN junction diode and find static, dynamic and reverse resistances of the diode from the graphs.	CO1
Task-2: ZENER DIODE	
Objective: To design a Zener diode based voltage regulator against variations of supply and load.	CO 2
Task-3: Half Wave Rectifier	
Objective: To design a half wave rectifier for the given specifications with and without filters and verify experimentally and draw suitable graphs.	CO 3
Task-4: FULL WAVE RECTIFIER	
Objective: To design a full wave rectifier for the given specifications with and without filters, and verify the given specifications experimentally. Vary the load and find ripple factor. And draw suitable graphs.	CO 3
Task-5: COMMON EMITTER CONFIGURATION	
Objective: To Verify the input and output characteristics of BJT in Common Emitter configuration experimentally and find the required h – parameters from the graphs	CO 3
Task-6:Common Emitter Configuration	
Objective: To Verify the input and output characteristics of BJT Common Emitter configuration experimentally and find h – parameters from the graph	CO3
Task-7: Common Collector configuration	

Objective: To Verify the input and output characteristics of BJT Common Collector configuration experimentally and find h – parameters from the graph	CO3
Task-8: MOSFET Characteristics	
Objective: To Study and draw the Volt Ampere characteristics of MOSFET	CO 4
Task-9: MOSFET As Switch	
Objective: To Study the Switching characteristics.	CO 4
Task-10:LED Characteristics	CO4
Objective: To Study the characteristics of LED	

Additional Experiments	
Task-11: VOLTAGE- DIVIDER BIAS CIRCUIT USING BJT.	
Objective: To Design and analyse the voltage- divider bias/self bias circuit using BJT	CO 1
Task-12: CLIPPERS AND CLAMPER CIRCUITS	
Objective: To Verify clipping and clamper circuits using PN junction diode and draw the suitable graphs	CO 1
Virtual Labs: **Virtual Labs Links:** 1. http://ee-iitb.vlabs.ac.in/ee-iitb/	

Text Book(s):

1. Fundamentals of Electronic Devices and Circuits Lab Manual By David Bell
2. Electronics Lab Manual By Navas K. A
3. Fundamentals of Electronic Circuit Design, Getting Started: MultiSim Textbook Edition byDavid J. Comer, Donald T. Comer.

Reference Book(s):

1. A Guide to Circuit Simulation and Analysis Using PSPICE by Paul W. Tuinenga
2. Ben G. Streetman, Sanjay Banerjee , Solid State Electronic Devices, Pearson Prentice Hall, 2006.
3. Robert T. Paynter, “Introductory Electronic Devices and Circuits”, Pearson Education, 7th Edition
4. Sedra A.S. and K.C. Smith, “Micro Electronic Circuits”, Oxford University Press, 5th Edition.

Web References:

1. https://www.academia.edu/28016003/EDC_by_Lal_kishore
2. https://www.academia.edu/9984476/Electronic_devices_and_circuit_theory_robert_boylestad_1

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2501	**Digital Logic Design Lab**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	0	0	3	33	1.5	40	60	100

Pre-requisite: Electronic Circuits, Basic Electronics

Course Objectives:

1. Students will learn and understand the Basics of digital electronics
2. Students are able to design basic logic circuits,
3. Able to design combinational circuits.
4. Able to design sequential circuits.

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

CO 1	Demonstrate the truth table of various expressions and combinational circuits using logic gates. (BL-2)
CO 2	Develop various combinational circuits such as adders, sub-tractors, comparators, multiplexers and de-multiplexers. (BL-3)
CO 3	Construct flips-flops, counters and shift registers. (BL-3)
CO 4	Simulate full adder and up/down counters. (BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	3						2	2		2	2	3
CO2	2		3						3	2		2	2	2
CO3	3	3	3						2	2		2	2	3
CO4	3	2	3						3	2		2	2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT	**CO**
Task-1 : STUDY OF LOGIC GATES	
Objective: To verify the Truth Table verification of AND, OR, NOT, NAND, NOR, EX-OR & EX-NOR gates.	CO1
Task-2 : FULL ADDER & SUBTRACTOR	
Objective: To realize the Full Adder and Sub-tractor circuits using basic logic gates and to verify their truth tables.	CO 2
Task-3: 4-BIT PARALLEL ADDER/SUBTRACTOR USING IC 7483	
Objective: To perform the addition and subtraction of two 4-bit binary numbers.	CO 2
Task-4: 4:1 MULTIPLEXER USING GATES	
Objective : To realize the 4 to 1 Multiplexer using gates.	CO 2
Task-5 : REALIZATION OF 1:8 DEMUX USING IC 74138	
Objective: To study the function of de-multiplexer using IC 74138.	CO 2

Task-6 : REALIZATION OF CLOCKED SR &JK FLIP FLOP	
Objective: 1. To verify the Truth Table of clocked SR Flip Flop 2. To verify the Truth Table of JK Flip Flop	CO 3
Task-7 : REALIZATION OF SHIFT REGISTERS USING IC7474	
Objective : To implement different types of shift registers like Serial In Serial Out [SISO], Serial In Parallel Out [SIPO], Parallel In Parallel Out [PIPO] and Parallel In Serial Out [PISO] using D-flip flops and to verify their observation table.	CO 3
Task-8: RING COUNTER AND JOHNSON (TWISTED RING) COUNTER	
Objective : To design and set up four bit Johnson and ring counter using JK Flip-Flops.	CO 4
Task-9: REALIZATION OF MOD – N COUNTER USING 7490	
Objective : To realize a Modulo N-counter using 7490 and verify the expected truth table and display the output waveform for a square wave input of given frequency. (N–to be specified, N= 9).	CO 4
Task-10: MAGNITUDE COMPARATOR	
Objective : To Design & Verify the 4-bit Magnitude Comparator using two 2-bit magnitude comparators.	CO 4
Additional Experiments	
Task-1: DESIGN AND IMPLEMENTATION OF SEQUENCE GENERATOR	
Objective : Design and testing of sequence generator using D flip flop	CO 2
Task-2: INTERFACING 7-SEGMENT DISPLAY SYSTEM WITH IC 7447 TO DISPLAY 0-9	
Objective : To interface 7-segment display with IC 7447 to display the decimal digits from 0 to 9.	CO 2
Virtual Labs: http://vlabs.iitb.ac.in/vlabs-dev/labs/digital-electronics/index.html	

Text Book(s):

1. M. Morris Mano, M.D. Ciletti, "Digital Design", 5th edition, Pearson, 2018.

2. R. P. Jain, "Modern Digital Electronics", 4th edition, McGraw Hill Education (India Private Limited), 2012.

3. Anand Kumar, Switching Theory and Logic Design, PHI,2008

Reference Book(s):

1. Digital Fundamentals, Thomas L. Floyd, Pearson Education, ISBN:9788131734483

2. Digital Principles and Applications, Malvino and Leach, TMH

Web References:

1. http://www.vlab.co.in/
2. http://www.asic-world.com/
3. http://electrical4u.com/
4. http://www.electronics-tutorials.ws

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2002	Network Theory lab							R-20
Semester	Hours / Week			Total	Credit	Max Marks		
	L	T	P	**hrs**	C	CIE	SEE	TOTAL
III	0	0	3	36	1.5	40	60	100

Pre-requisite: Basic concepts of electrical circuits

Course Objectives:

A. To understand the Series Resonance ,Parallel Resonace,
B. To understand Locus Of RLC Circuits.
C. To learn to compute and to analyze the DC Transients,AC Transients for RLC series parallel circuits
D. To learn and apply the concept of Two port networks to the RLC networks
E. To analyse the types of filters and design the filters for required conditions for a given system.

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

CO 1	Demonstrate the concept of resonance and locus diagrams of R,L,C.(BL-2)
CO 2	Analyze the transient response of AC and DC circuits.(BL-3)
CO 3	Determine experimentally the two port network parameters and filters and verify their result.(BL-2)

TASK-1 Transient response of RL and RC circuit
Objective: To verify the Transient response of RL circuit and to find the time constant of RL and RC network.
TASK-2 Transient response of RLC series circuit
Objective: To verify the Transient response of RLC series circuit
TASK -3 Transient response of RLC parallel circuit
Objective: To verify the Transient response of RLC parallel circuit
TASK-4 Locus Diagrams of RL and RC Series Circuits
Objective: To Plot the current locus diagrams for RL and RC circuits.
TASK-5 Frequency response of series resonance circuit with analysis and design
Objective: To determine resonant frequency, band width and Q-factor for series RLC circuits.
TASK-6 Frequency response of parallel resonance circuit with analysis and design.
Objective: To determine resonant frequency, bandwidth and Q-factor for parallel RLC circuits
TASK-7 Z and Y Parameters
Objective: To calculate and verify 'Z' parameters and Y parameters of two-port network.
TASK-8 Transmission and Hybrid Parameters
Objective: To calculate and verify 'ABCD' parameters and „h‟ parameters of two-port network
TASK -9 Design and frequency response of constant 'k' low pass & high pass filters
Objective: To plot the frequency response of Low pass filter and High pass filter.
TASK-10 Design and frequency response of Band pass filter

Objective:
To study frequency response of Band pass filter

Additional Experiments:
PSPICE SIMULATION

TASK-11 Simulation of AC Circuits

Objective:
To simulate a simple AC circuits using PSpice

TASK-12 DC Transient Response

Objective:
To simulate a simple DC circuits using PSpice

Text Book(s):
1. A Sudhakar, Shyammohan S Palli," Circuits & Networks", Tata Mc Graw- Hill,4thEdition,2010
2. A Chakrabarthy,"ElectricCircuits",DhanpatRai&Sons,6thEdition,2010.

Reference Book(s):
1. Willam Hayt, Jack E.Kemmerly, Steven M. Durbin," Engineering Circuit Analysis ", Tata Mc Graw-Hill, 8th Edition 2012
2. Rudra ratap," Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers", Oxford University Press,1st Edition,1999.

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3		2					2	2			1	1
CO2	3	3		2					1	2			1	1
CO3	3	3	2	2	2				2	2			3	3

1: Low, 2-Medium, 3- High

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2003	ANALOG ELECTRONICS							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge on concepts of electronic devices.

Course Objectives:

1. To study the effect of negative feedback on amplifier characteristics.
2. To design RC & LC oscillator circuits.
3. To analyze amplifier frequency response at low and high frequencies.
4. To study coupling schemes and multi stage amplifiers.
5. To analyze the large signal amplifiers and tuned amplifiers.

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

CO 1	Analyze the small signal amplifiers at low frequencies and high frequencies.(BL-4)
CO 2	Illustrate the concepts of negative feedback amplifiers. (BL-2)
CO 3	Illustrate the working principle of oscillators. (BL-2)
CO 4	Analyze the parameters of multi stage amplifiers.(BL-4)
CO 5	Interpret the concepts of Power amplifiers and Tuned amplifiers.(BL-2)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2										2	
CO2	3	3	2										2	
CO3	3	3	1										1	
CO4	3	3	2	2									1	2
CO5	3	2	1	2									2	3

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	SMALL SIGNAL LOW FREQUENCY & HIGH FREQUENCY ANALYSIS	11 Hrs

Low Frequency Analysis:

Transistor hybrid model, determination of h-parameters, conversion of h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis.

High Frequency Analysis:

Hybrid- π Common Emitter transistor model, Hybrid π conductance's, Hybrid π capacitances, Validity of hybrid π model, determination of high-frequency parameters in terms of low-frequency parameters , CE short circuit current gain, Current gain with resistive load.

At the end of the Module 1, students will be able to:

1. Define Transistor hybrid model.(BL-1)

2. Compare different transistor amplifiers. (BL-2)
3. Explain the effect of coupling and emitter bypass capacitors. (BL-2)
4. Explain the gain bandwidth product of amplifiers.(BL-2)
5. Analyze the Emitter follower frequency response at high frequencies.(BL-4)
6. Analyze the hybrid π CE transistor model. (BL-4)

MODULE -2	**FEEDBACK AMPLIFIERS**	**9 Hrs**

Feedback concept, types of feedback, classification, feedback topologies, Characteristics of negative feedback amplifiers, Generalized analysis of feedback amplifiers, Determination of input & output impedance of different feedback amplifier, Method of Analysis of Feedback Amplifiers.

At the end of the Module 2, students will be able to:

1. Define negative and positive feedback in amplifiers.(BL-1)
2. Explain the effect of negative feedback on amplifier characteristics.(BL-2)
3. Compare different feedback topologies. (BL-2)

MODULE-3	**OSCILLATORS**	**9 Hrs**

Oscillator principle, condition for oscillations, types of oscillators, Generalized analysis of LC Oscillators, Hartley oscillator & Colpitt's oscillator using BJT and FET with relevant analysis, Crystal oscillators, RC-phase shift oscillator & Wein bridge oscillator using BJT with relevant analysis, Frequency & amplitude stability of oscillators.

At the end of the Module 3, students will be able to:

1. Explain condition for oscillations and types of oscillators.(BL-2)
2. Illustrate the operation of RC oscillators.(BL-2)
3. Explain the operation of LC oscillators.(BL-2)
4. Demonstrate the frequency and amplitude stability of oscillators(BL-2)

MODULE-4	**MULTISTAGE AMPLIFIERS**	**10 Hrs**

Classification of amplifiers, Methods of coupling, Generalized analysis of Cascaded amplifier, Analysis of two stage RC coupled amplifier with frequency response, Cascode amplifier, Emitter follower , Darlington pair amplifier, Differential amplifier using BJT.

At the end of the Module 4, students will be able to:

1. Explain the concept of cascading and coupling schemes(BL-2)
2. Analyze two stage RC coupled amplifier (BL-4)
3. Summarize the darlington amplifier parameters.(BL-2)
1. Explain differential amplifier with BJT. (BL-2)

MODULE-5	**POWER AMPLIFIERS & TUNED AMPLIFIERS**	**9 Hrs**

Power Amplifiers: Classification, Class A Power Amplifier, Distortion, Second harmonic Distortion, Class B Amplifier, Push- pull amplifier, Complementary Symmetry Class AB Amplifier, Class C Amplifier, Thermal stability and Heat sink.

Tuned Amplifiers: Tuned Circuit, Q-Factor, Single tuned capacitive coupled amplifier, Effect of Cascading Single tuned amplifiers on Band width, Stability.

At the end of the Module 5, students will be able to:

1. List types of power amplifiers & compare the voltage and power amplifier.(BL-2)
2. Discuss heat sinks, thermal stability and distortions.(BL-1)
3. Explain the concept of tuned circuits. (BL-02)
4. Compare different tuned amplifiers. (BL-02)
5. Derive the expression for gain and bandwidth of a single tuned amplifier. (BL-02)
6. Describe the effect of cascading on bandwidth of tuned amplifiers. (BL-02)

Total hours:	**48 Hours**

Content beyond syllabus:

1. Power amplifiers using MOSFET-efficiency of MOSFET power amplifier.
2. Cascsed amplifier using FET-small signal analysis of cascade amplifier using FET.

Self-Study:

Contents to promote self-Learning:

SNO	Module	Reference
1	**Small Signal Low Frequency & High Frequency Analysis**	https://www.tutorialspoint.com/amplifiers/amplifiers_classification.htm https://www.tutorialspoint.com/amplifiers/amplifiers_classification.htm
2	**Feedback Amplifiers**	https://www.tutorialspoint.com/amplifiers/amplifiers_feedback.htm
3	**Oscillators**	https://www.tutorialspoint.com/sinusoidal_oscillators/sinusoidal_oscillators_introduction.htm
4	**Multistage Amplifiers**	https://www.tutorialspoint.com/amplifiers/multi_stage_transistor_amplifier.htm
5	**Power Amplifiers & Tuned Amplifiers**	https://www.tutorialspoint.com/amplifiers/classification_of_power_amplifiers.htm https://www.tutorialspoint.com/amplifiers/tuned_amplifiers.htm

Text Book(s):

1. J. Millman and C.C. Halkias, "Integrated Electronics", McGraw-Hill, 1972.
2. Donald A. Neaman, "Electronic Circuit Analysis and Design", McGraw Hill.
3. Electronic Circuit Analysis 4th Edition – by K. Lal Kishore , BS Publications.

Reference Book(s):

1. Robert T. Paynter, "Introductory Electronic Devices and Circuits", Pearson Education, 7th Edition
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits Theory" Pearson/Prentice Hall, 9th Edition, 2006.
3. Sedra A.S. and K.C. Smith, "Micro Electronic Circuits", Oxford University Press, 5th Edition.
4. Salivahanan, N.Suressh Kumar, A. Vallavaraj, "Electronic Devices and Circuits", Tata McGraw Hill, Second Edition

Online Resources/ Web references:

1. https://www.academia.edu/28016003/EDC_by_Lal_kishore
2. https://www.academia.edu/9984476/Electronic_devices_and_circuit_theory_robert_boylestad_1_
3. Donald A. Neaman, "Electronic Circuit Analysis and Design", McGraw Hill.
4. https://nptel.ac.in/courses/122/106/122106025/
5. https://www.tutorialspoint.com/semiconductor_devices/index.htm
6. https://www.allaboutcircuits.com/textbook/semiconductors/
7. http://www.satishkashyap.com/

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2004	CONTROL SYSTEMS							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	2	0	0	32	2	40	60	100

Pre-requisite: Basics concepts of Electrical Circuits & Basics of Laplace transform

Course Objectives:

1. To understand the merits and demerits of open and closed loop control systems
2. To understand the step response of second order control systems
3. To plot Root locus for the given system transfer function
4. To understand the stability analysis from Bode plot, polar plots
5. To understand the merits of state space analysis over time domain analysis

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

CO 1	Analyze the differential equations for mechanical and electrical systems and obtain the transfer function from block diagrams, servo motors and signal flow graphs (BL - 3)
CO 2	Analyze the time domain specifications, steady state errors and to learn time response analysis of first and second order systems(BL - 3)
CO 3	Summarize the concepts Routh's stability and Root locus to find the stability of the system (BL - 2)
CO 4	Summarize the frequency domain specifications from Bode, Polar, Nyquist plots and evaluate the frequency domain specifications(BL - 2)
CO 5	Summarize the concept of state space analysis, controllability and Observability and to obtain the transfer function. (BL - 2)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3											3
CO2	3	3	1											3
CO3	1	2	2										3	
CO4	1	1	3	1										3
CO5	1	3	3											3

1- Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	INTRODUCTION TO CONTROL SYSTEMS	8 hrs

Examples & Classification of control systems, merits and demerits of Open Loop and closed loop control systems, Effects of positive and negative feedback

Mathematical modelling and transfer function of Electrical and Mechanical systems, Analogous systems.

Control System Components: DC Servo motor, AC Servo motor , Synchro Transmitter & Receiver (2h)

Block diagrams: Block diagram representation of control systems, Block Diagram Reduction Rules .(4h)

Signal flow graph: Definitions, Reduction using Mason's gain formula.(3h)

At the end of the Module 1, students will be able to:

1.Identify the difference between open loop and closed loop systems **(BL=3)**

2.Understand the effect of feedback on system performance **(BL=2)**

3. Apply the block diagram reduction to simplify the given system **(BL=3)**

MODULE-2	TIME RESPONCE ANALYSIS	7 hrs

Standard test signals, Time response of first order and second order un damped, under damped, critically damped and over damped systems, Time domain specifications. (6h)

Error Analysis: Steady state Error**,** static error coefficient of type 0,1, 2 systems (3h)

At the end of the Module 3, students will be able to:

1. Understand the importance of basic test signals . **(BL=2)**
2. Understand the Time response of second order system with different dampings . **(BL=2)**
3. Find steady state error for the given system for any input signal. . **(BL=1)**

MODULE-3	STABILITY ANALYSIS	6 hrs

Stability: The concept of stability, Routh's stability criterion, limitations of Routh's stability.(4h)

Root locus plot: The root locus concept, construction of root loci, effects of adding poles and zeros to G(s)H(s) on the root loci. (5h)

At the end of the Module 4, students will be able to:

1. Understand various stability issues **(BL=2)**
2. Apply Routh's stability criteria to given system for stability assessment **(BL=3)**
3. construct the Root locus plot for the given system **(BL=3)**

MODULE-4	FREQUENCY RESPONSE ANALYSIS	6 hrs

Introduction, Frequency domain specifications, Bode plot, polar plot, Transfer function from the Bode Diagram, Stability Analysis from Bode Plots. Polar Plots, Nyquist Plots. (8h)

Compensation Techniques: Lag, Lead, Lag-Lead Compensators.(3h)

At the end of the Module 5, students will be able to:

1. Understand various frequency domain specifications. **(BL=2)**
2. Explain the Bode plot for the given system. **(BL=2)**
3. Find the stability of given system from Bode plot and polar plot. **(BL=1)**

MODULE-5	STATE SPACE ANLYSIS	5 hrs

Introduction: Concepts of state, state variables and state model, derivation of state models from differential equations, Diagonalization. (5h)

Solution of state equation: Solving the Time invariant state Equations, State Transition Matrix and it's Properties. (2h)

The concepts of controllability and observability. (2h)

At the end of the Module 6, students will be able to:

1. Understand the importance of state space analysis **(BL=2)**
2. Find the state model for the given transfer function through various techniques. **(BL=1)**
3. Examine the controllability and observability of the given state model. **(BL=1)**

Total hours:	**32 hours**

Content beyond syllabus:

1. Introduction to P, PI and PID controllers.
2. State space representation of Armature and Field controlled DC motor.

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Open Loop and closed loop control systems	CO1	https://nptel.ac.in/courses/107/106/107106081/
2	Time response of second order system	CO2	https://www.tutorialspoint.com/control_systems/control_systems_time_response_analysis.htm
3	Routh's stability criteria	CO3	https://nptel.ac.in/courses/107/106/107106081/
4	Frequency domain specifications	CO4	https://www.tutorialspoint.com/control_systems/control_systems_frequency_response_analysis.htm
5	Controllability and observability	CO5	https://www.tutorialspoint.com/control_systems/control_systems_state_space_analysis.htm

Text Book(s):

1."Control Systems Engineering, I. J. Nagrath and M. Gopal, New Age International Publishers, 5th edition, 2007, Reprint 2012.

2. Control Systems by A. Anand Kumar, PHI Learning pvt. Ltd., second edition

Reference Book(s):

1. Norman S. Nise, "Control Systems Engineering", John Wiley & Sons PTE Ltd, 2013
2. Modern Control Engineering, Katsuhiko Ogata, PEARSON, 1st Impression 2015.
3. Automatic Control Systems, Farid Golnaraghi and Benjamin. C. Kuo, WILEY, 9th Edition, 2010.
4. N C Jagan, "Control Systems", BS Publications, 1st Edition, 2007.
5. S Palani, "Control Systems Engineering", Tata McGraw-Hill Publications, 1st Edition, 2001.
6. N K Sinha, "Control Systems", New Age International Publishers, 1st Edition, 2002.

Online Resources/ Web References:

1.http://www.ent.mrt.ac.lk/~rohan/teaching/EN5001/Reading/DORFCH1.pdf
2.https://drive.google.com/file/d/0B0CHtxo5u4TNWldoYXVnS3MxV0k/view
3.http://www.aoengr.com/SampleBook.pdf
4.https://www.accessengineeringlibrary.com/content/book/9781259643835
5.http://175.101.102.82/moodle/
6. https://nptel.ac.in/courses/107/106/107106081/
7. https://www.youtube.com/watch?v=XYbrgwKP_6k
8. https://drive.google.com/file/d/0B2D2Vl5_6vK1WUx5T29kME1xelk/view
9. https://www.youtube.com/watch?v=sUDoTw_LIbk

NARAYANA ENGINEERING COLLEGE :: NELLORE								
20EC2005	ELECTROMAGNETIC THEORY AND TRANSMISSION LINES							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

Pre-requisite: Vector Calculus, Knowledge of Integration and differentiation.

Course Objectives:

1. To study different coordinate systems, Physical significance of Divergence, Curl and Gradient.
2. To acquire knowledge on electric and magnetic fields in both static and dynamic domains.
3. To understand wave concept with the help of Maxwell's equations.
4. To Analyze reflection and refraction of EM waves and Electromagnetic wave propagation in different media.
5. To introduce concepts of polarization and fundamental theory of electromagnetic waves in transmission lines and their practical applications.

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

CO 1	Apply the Coulomb's law and Gauss law to different charge distributions.(BL-3)
CO 2	Make use of Biot-Savart Law, Ampere's Circuit law to static current distributions.(BL-3)
CO 3	Analyze the electric and magnetic fields.(BL-4)
CO 4	Interpret the characteristics of EM Wave.(BL-2)
CO 5	Illustrate the concepts of transmission lines.(BL-2)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2		2									1	
CO2	3	3		2									1	
CO3	3	2	2										2	
CO4	3	1	1										2	2
CO5	3	2	2										2	2

1- Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	Electrostatics	13 Hrs

Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell's Two Equations for Electrostatic Fields, Electric dipole, Energy Density, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

At the end of the Module 1, students will be able to:

1. Summarize basic laws of static electric field. (BL-2)
2. Derive the Maxwell's equations for electrostatic fields. (BL-3)
3. Solve problems applying laws of electrostatics. (BL-3)
5. Explain electric energy and potential (BL-2)
6. Define currents of conductors and dielectrics (BL-1)
7. Illustrate Poisson's and Laplace's Equations (BL-2)
8. Summarize types of capacitors (BL-2)

MODULE -2	Magneto statics	9 Hrs

Biot-Savart's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Magnetic torque and moment, Magnetic dipole, Inductances and Magnetic Energy, Illustrative Problems.

At the end of the Module 2, students will be able to:

1. Summarize basic laws of static magnetic field. (BL-2)
2. Derive the Maxwell's equations for magnetic fields. (BL-3)
3. Solve problems applying laws of magneto statics. (BL-3)

MODULE-3	Maxwell's Equations for Time Varying Fields	6 Hrs

Faraday's Law and Transformer e.m.f, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Forms and Word Statements. Boundary Conditions of Electromagnetic fields: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Illustrative Problems.

At the end of the Module 3, students will be able to:

1. Derive Maxwell's equations for time varying electromagnetic fields. (BL-3)
2. Apply the boundary conditions of EM fields at the interface of different media.(BL-3)
3. Solve problems on time varying maxwell's equations of electromagnetic fields. (BL-3)

MODULE-4	EM Wave Characteristics	12 Hrs

Wave Equations ,Uniform Plane Waves – Definition, All Relations between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Wave Propagation, Polarization, Reflection and Refraction of Plane Waves – Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Surface Impedance, Poynting Vector, and Poynting Theorem – Applications, Power Loss in a Plane Conductor, Illustrative Problems.

At the end of the Module 4, students will be able to:

1. Derive wave equations for different media. (BL-3)
2. Explain concept of polarization of electromagnetic waves. (BL-2)
3. Solve problems using wave characteristics equations (BL-3)
4. Explain principles of reflections and refraction for different incidences. (BL-2)
5. Explain concept of power flow using Pointing vector. (BL-2)
6. Solve problems on Brewster angle, power flow and surface impedance. (BL-3)

MODULE-5	Transmission Lines	8 Hrs

Introduction, Transmission line parameters (Primary and Secondary), Transmission line equations, Input impedance, Standing wave ratio & power, Smith chart & its applications, Applications of transmission lines of various lengths, Micro-strip transmission lines – input impedance, Illustrative Problems.

At the end of the Module 6, students will be able to:

1.Study the principles of transmission lines and concept of smith chart.(BL-2)

2.Derive the input impedance of transmission line.(BL-3)

3. Calculate the line parameters through problem solving.(BL-3)

4.Study the applications of different lengths of transmission lines.(BL-2)

Total Hours:	**48 Hours**

Content beyond syllabus:

1. **Guided Waves:** Propagation of TE waves between parallel planes.
2. Propagation of TM waves between parallel planes.
3. Propagation of TEM waves between parallel planes.
4. Propagation of TEM waves between parallel planes.

Self-Study:

Contents to promote self-Learning:

S.NO	Module	Reference
1	**Electrostatics**	https://lecturenotes.in/subject/77/electromagnetic-theory-emt https://gradeup.co/electronics-communication/electromagnetic-theory https://lecturenotes.in/subject/77/electromagnetic-theory-emt https://gradeup.co/electronics-communication/electromagnetic-theory
2	**Magnetostatics**	https://lecturenotes.in/subject/77/electromagnetic-theory-emt https://gradeup.co/electronics-communication/electromagnetic-theory
3	**Maxwell's Equations for Time-varying fields**	https://lecturenotes.in/subject/77/electromagnetic-theory-emt https://gradeup.co/electronics-communication/electromagnetic-theory
4	**EM Wave Characteristics**	https://lecturenotes.in/subject/77/electromagnetic-theory-emt https://gradeup.co/electronics-communication/electromagnetic-theory https://lecturenotes.in/subject/77/electromagnetic-theory-emt https://gradeup.co/electronics-communication/electromagnetic-theory
5	**Transmission Lines**	https://youtu.be/b_VCIdXEK2I https://youtu.be/OALlAnOif2c https://youtu.be/-LS8qhXTN9M

Text Book(s):

1. Matthew N.O. Sadiku, S.V.Kulkami, "Elements of Electromagnetics", Oxford Univ. Press, 6th ed., 2015.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics", TMH, 7th ed., 2006.

Reference Book(s):

1. E.C. Jordan and K.G. Balmain, “Electromagnetic Waves and Radiating Systems”, 2nd Edition, PHI, 2000
2. John D. Krauss, “Electromagnetics”, 4th Edition,McGraw- Hill publication1999.

Online Resources/ Web References:

1. https://nptel.ac.in/courses/108/104/108104087/
2. https://nptel.ac.in/courses/115/101/115101005/
3. http://nptel.ac.in/courses/117101056/
4. www.nptelvideos.in/2012/12/transmission-lines-and-em-waves.html
5. https://www.khanacademy.org/
6. https://www.tutorialspoint.com/electromagnetics_theory/index.asp
7. https://swayam.gov.in/nd1_noc19_ph08/preview
8. http://www.a-zshiksha.com/forum/viewtopic.php?f=147&t=61578
9. https://freevideolectures.com/course/3288/electromagnetic-theory/7
10. https://www.youtube.com/watch?v=pGdr9WLto4A
11. https://youtu.be/6Nj2oqayIYc (Polarization)
12. https://youtu.be/-Kw-vy68CEA (Oblique incidence of plane waves)
13. https://youtu.be/fh2MLGVtb0U (Power Loss in a Plane Conductor)
14. https://www.tcyonline.com/tests/electromagnetic-theory
15. https://ocw.mit.edu/courses/physics/8-03sc-physics-iii-vibrations-and-waves-fall-2016/part-ii-electromagnetic-waves/lecture-12/
16. www.dannex.se/theory/1.html
17. www.tandfonline.com/toc/uemg20/current
18. https://youtu.be/qsXGBjXf8GA

NARAYANA ENGINEERING COLLEGE: NELLORE								
20EC2006	PROBABILITY AND RANDOM PROCESS							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	3	0	0	48	3	40	60	100

Pre-requisite:

- Set theory
- Integrations, differentiations, partial differentiations formulas
- Terms involved in Electronics & Communications

Course Objectives:

1. To understand the basic probability concepts and to find the probability.
2. To acquire skills in handling situations involving more than one random variable and functions of random variables.
3. To analyze the concept of statistical averages.
4. To understand types of random processes, Auto-correlation, Cross Correlation and power spectral density and cross power spectral density
5. To understand the principles of random process relate to system concepts

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

CO 1	Interpret the concepts of sample spaces and set theory to calculate probabilities (BL-2)
CO 2	Apply the concept of random variables with probability density and distribution functions to compute probabilities for complex problems. (BL-3)
CO 3	Compute the statistical averages for multiple random variables using joint probability density and distribution functions. (BL-2)
CO 4	Interpret the concept of Power Spectrum Density & Cross Power Spectrum density related to temporal characteristics and spectral characteristics (BL-4)
CO 5	Apply the principles of a random process for solving system related problems. (BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	3	2	2											
CO2	2	2	2											
CO3	2	3	2	3										
CO4	3	3	3	3									2	
CO5	3	2	2	3									2	

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**PROBABILITY**	**9 Hrs**
Probability introduced through Sets and Relative Frequency; Probability space& Axioms; Mathematical Model of Experiments**,** Joint probability, Conditional probability, Total probability and Baye's theorem		
At the end of the Module 1, students will be able to: 1. Understand the fundamental concepts of probability (BL-2) 2. Find the probability for real time examples (BL-1) 3. Find total probability (BL-1) 4. Apply Baye's theorem for different real time applications (BL-3)		
MODULE -2	**DISCRETE& CONTINUOUS RANDOM VARIABLES**	**9 Hrs**
Probability mass function, probability distribution function, example random variables and distributions and density functions; Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random Variables; Central limit theorem (without+ proof)		
At the end of the Module 2, students will be able to: 1. Understand probability distribution and density functions (BL-2) 2. Outline the importance of the central limit theorem (BL-2) 3. Solve the moments to the sum of random variables (BL-3) 4. Apply different probability distribution and density functions on random variables.(BL-3)		
MODULE-3	**OPERATIONS ON MULTIPLE RANDOM VARIABLES**	**9 Hrs**
Expected value of a function of random variables, joint moments about the origin, joint central moments Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables. Markov, Chebyshev and Chernoff bounds.		
At the end of the Module 3, students will be able to: 1. Understand the moments for multiple random variables. (BL-2) 2. Understand the concepts of linear transformation of Gaussian random variables. (BL-2) 3. Apply the different operations to multiple random variables. (BL-3)		
MODULE-4	**RANDOM PROCESSES: TEMPORAL CHARACTERISTICS & SPECTRAL CHARACTERISTICS**	**12 Hrs**
The random process concept, classification of processes, concept of stationary and statistical independence. Correlation function. Power spectrum Properties, Relationship between power spectrum and autocorrelation function, properties of power spectral density, relation between cross – power density spectrum and cross correlation, properties of cross power spectral density; problems.		
At the end of the Module 4, students will be able to: **1.** Define continuous and discrete-time random processes. (BL-1) **2.** Explain various Stationary Processes. (BL-2) 3. Apply the concepts and its properties of auto correlation. (BL-3) 4. Apply the concepts and its properties cross correlation functions. (BL-3) 5. Understand the concepts of power spectral density & cross power spectral density (BL-2) 6. Apply PSD & CPSD properties on random process. (BL-3) 7. Apply CPSD properties on random process. (BL-3)		
MODULE-5	**RANDOM SIGNAL RESPONSE OF LINEAR SYSTEMS**	**9 Hrs**

System Response – Convolution, Mean and Mean squared Value of System Response, autocorrelation Function of Response, Cross Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, Band pass, Band Limited and Narrowband Processes, Properties**.**

Noise Definitions: White Noise, Ideal low passfiltered white noise, RC filtered white noise.

At the end of the Module 6, students will be able to:

1. Relate the theory of stochastic processes to analyze linear systems. (BL-2)
2. Understand the concepts of low pass and band pass noise models for random processes. (BL-2)
3. Apply the statistical characteristics to response of linear systems. (BL-3)
4. Analyse the output characteristics of a system when input is an WSS process. (BL-4)

Total hours:	**48 Hours**

Content beyond syllabus:

1. Discrete time markov process
2. Continuous time markov process

Self-Study:

Contents to promote self-Learning:

SNO	**Module**	**Reference**
1	PROBABILITY	https://byjus.com/maths/probability/ https://www.britannica.com/science/probability-theory
2	Discrete& Continuous Random Variables	http://www.nptelvideos.com/lecture.php?id=10402
3	Operations on multiple random variables	https://onlinelibrary.wiley.com/doi/pdf/10.1002/9780470171455.app1 https://www.researchgate.net/publication/229766295_Autocorrelation_and_Cross-Correlation_Methods
4	Random Processes: Temporal Characteristics Random Processes – Spectral Characteristics	https://www.sciencedirect.com/topics/engineering/stationary-random-process https://www.cygres.com/OcnPageE/Glosry/SpecE.html https://faculty.washington.edu/dbp/PDFFILES/GHS-AP-Stat-talk.pdf
6	Random Signal Response of Linear Systems	https://www.projectrhea.org/rhea/index.php/ECE600_F13_Linear_Systems_with_Random_Inputs_mhossain https://faculty.kfupm.edu.sa/ee/muqaibel/Courses/E570%20Stochastic%20Processes/notes/RP/Linear%20Systems%20with%20Random%20Inputs.pdf

Reference Book(s):

1. R.P. Singh and S.D. Sapre, "Communication Systems Analog & Digital", TMH, 1995.
2. Henry Stark and John W. Woods, "Probability and Random Processes with Application toSignal Processing", Pearson Education, 3rd Edition.
3. George R. Cooper, Clave D. MC Gillem, "Probability Methods of Signal and System Analysis", Oxford, 3rd Edition, 1999.
4. S.P. Eugene Xavier, "Statistical Theory of Communication", New Age Publications, 2003.
5. B.P. Lathi, "Signals, Systems & Communications", B.S. Publications, 2003
6. keiser, gerd, "probability theory and stochastic processes", TMH publications, 4th Edition.

Online Resources/ Web References:

MODULE-1

1. http://www.nptelvideos.com/lecture.php?id=10375
2. http://www.nptelvideos.com/lecture.php?id=10376
3. http://www.nptelvideos.com/lecture.php?id=10378
4. http://www.nptelvideos.com/lecture.php?id=10379

MODULE-2 &3

1. http://www.nptelvideos.com/lecture.php?id=10386
2. http://www.nptelvideos.com/lecture.php?id=10387
3. http://www.nptelvideos.com/lecture.php?id=10388
4. http://www.nptelvideos.com/lecture.php?id=10389
5. http://www.nptelvideos.com/lecture.php?id=10390
6. http://www.nptelvideos.com/lecture.php?id=10402

MODULE-4

1. http://www.nptelvideos.com/lecture.php?id=10403
2. http://www.nptelvideos.com/lecture.php?id=10404
3. http://www.nptelvideos.com/lecture.php?id=10407
4. http://www.nptelvideos.com/lecture.php?id=10408

MODULE-5

1. http://www.nptelvideos.com/lecture.php?id=10406
1. https://www.tutorialspoint.com/probability/index.asp
2. https://byjus.com/maths/bayes-theorem/
3. https://www.tutorialspoint.com/statistics/binomial_distribution.htm
4. https://web.sonoma.edu/esee/courses/es442/supp/correlation_applications.pdf
5. https://www.jospt.org/doi/pdf/10.2519/jospt.2009.2969

NARAYANA ENGINEERING COLLEGE: NELLORE							
20EC2007	Signals and Systems						R20
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**	
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
IV	**3**	**0**	**0**	**48**	**3**	**40**	**60**	**100**

Pre-requisite:

- knowledge on Integration, Differentiations and Transforms

Course Objectives:

- To understand the mathematical description and representation of continuous and discrete-time signals and systems.
- To study the frequency representation of periodic signals.
- To characterize signals and systems using frequency domain methods.
- To study sampling theorem and to convert continuous-time signals to discrete-time signals with different techniques and vice-versa.
- To analyze continuous and discrete-time signals and systems using Laplace & Z- Transform mathematical tool.

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

CO 1	Interpret the concept of various signals and linear Time invariant Systems. (BL-2)
CO 2	Interpret the concept of Fourier series for Continuous time signals.(BL-2)
CO 3	Apply continuous time Fourier Transform for Continuous time signals .(BL-3)
CO 4	Apply Sampling Theorem for Continuous time signals.(BL-3)
CO 5	Analyze Laplace and Z-transform for continuous and discrete time systems.(BL-4)

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2										1	
CO2	3	3	3	2									3	2
CO3	3	3	2	2									2	1
CO4	3	2	3										2	
CO5	2	3	3	1									2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT		
MODULE – 1	**INTRODUCTION TO SIGNALS AND SYSTEMS**	**9 Hrs**
SIGNALS AND SYSTEMS: Basic definitions and classification of Signals**,** Basic operations on signals, Classification of Continuous-Time and Discrete-Time Systems, Basic System Properties, Linear Time-Invariant Systems - Discrete-Time LTI Systems, Convolution Sum, Continuous-Time LTI Systems Convolution Integral, Properties of Linear Time-Invariant Systems.		
At the end of the Module 1, students will be able to: 1. Understand classifications of the signals and systems. **(BL-2)** 2. Explain continuous and discrete time signals. **(BL-2)** 3. Understand the concept of convolution. **(BL-2)**		
MODULE -2	**FOURIER SERIES**	**8 Hrs**
Representation of Fourier series, Continuous time periodic signals, Dirichlet's conditions, Properties of CT Fourier Series, Trigonometric Fourier Series and Exponential Fourier Series with examples, Complex Fourier spectrum, Fourier series representation of a periodic signals.		
At the end of the Module 2, students will be able to: 1. Apply Fourier series for the periodic signals. **(BL-3)** 2. Solve problems by using Fourier series properties. **(BL-3)** 3. Sketch the complex Fourier spectrum. **(BL-3)**		
MODULE-3	**FOURIER TRANSFORMS**	**10 Hrs**
Deriving Fourier Transform from Fourier series, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of CT Fourier Transform, Systems characterized by Linear constant coefficient differential equations. The Magnitude-Phase Representation of the Fourier Transform, The Magnitude-Phase Representation of the Frequency Response of LTI Systems**.** Definition, Computation and properties of DTFT for different types of signals and systems.		
At the end of the Module 3, students will be able to: 1. Analyze the periodic and aperiodic signals by applying Fourier transforms. **(BL-4)** 2. Interpret the Magnitude-Phase Representation of F.T & LTI Systems. **(BL-2)** 3. Solve problems by using F.T properties. **(BL-3)** 4. Analyze the spectral characteristics of signals using Fourier transform. **(BL-4)** 5. Analyze of DTFT for different types of signals and systems. **(BL-4)**		
MODULE-4	**SAMPLING**	**7 Hrs**
Representation of a Continuous Time Signal by its Samples - Sampling Theorem, Reconstruction of a Signal from its Samples Using Interpolation, types of sampling-natural sampling, flat- top sampling and impulse sampling, Effect of under sampling -Aliasing.		
At the end of the Module 4, students will be able to: 1. Illustrate the representation of a Continuous Time Signal by sampling. **(BL-2)** 2. Understand the reconstruction of a sampled signal using Interpolation. **(BL-2)** 3. Compare different sampling techniques. **(BL-2)** 4. Solve problems for nyquist interval and nyquist rate. **(BL-3)**		
MODULE-5	**LAPLACE TRANSFORMS & Z-TRANSFORMS**	**14 Hrs**
Definition, Region of Convergence, Properties, Inverse Laplace Transform, Relationship between Fourier and Laplace Transforms, Laplace Transform Pairs, Analysis and Characterization of LTI Systems Using the Laplace Transform . Definition**,** Region of Convergence, Properties of the z-Transform, Inverse z-Transform, Relation between Fourier and Z Transforms, Common z- Transform Pairs, Analysis and Characterization of LTI Systems Using z-Transforms**.**		
At the end of the Module 4, students will be able to: 1. Understand the properties of Laplace transform. **(BL-2)**		

2. Analyze the continuous-time and discrete-time signals and systems using Laplace transform. **(BL-4)**
3. Interpret the relationship between Fourier and Laplace Transforms. **(BL-2)**
4. Find the stability of the systems using ROC. **(BL-1)**
5. Understand the properties of Z - transform. **(BL-02)**
6. Analyze the discrete-time signals and systems using Z - transforms. **(BL-04)**
7. Interpret the relationship between Fourier and Z - Transforms. **(BL-02)**
8. Find the stability of the systems using ROC. **(BL-01)**

Total hours:	**48 Hours**

Content beyond syllabus:

1. Discrete Time Fourier transform
2. Discrete Fourier transform

Self-Study:

Contents to promote self-Learning:

SNO	Module	Reference
1	Introduction to Signals and Systems	https://nptel.ac.in/content/storage2/courses/117101055/downloads/Lec-10.pdf
2	Fourier series	http://jntuhsd.in/uploads/programmes/Module__7___Properties_of_Fourier_Series_and_Complex_Fourier_Spectrum.PDF
3	Fourier transforms	http://jpkc.gnnu.cn/jpkc/Signal/wangluokecheng/Content/6.2%20The%20MagnitudePhase%20Representation%20of%20the%20Frequency%20Response%20of%20LTI%20Systems.htm
4	Sampling	https://nptel.ac.in/content/storage2/courses/117101055/downloads/PS3.pdf
5	Laplace Transform& Z-Transforms	https://www.yumpu.com/en/document/read/22782683/chapter-4-analysis-and-characterization-of-lti-systems https://www.youtube.com/watch?v=8CRShpEn9tI

Text Book(s):

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, “Signals and Systems”, 2ndEdition, PHI, 2009.
2. Simon Haykin and Van Veen, “Signals & Systems”, 2ndEdition, Wiley, 2005.
3. Signals and Systems, J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, TMH

Reference Book(s):

1. Simon Haykin and B. Van Veen, Signals & Systems, John Wiley, 2nd Edition, 2010.
2. A. Anand Kumar, Signals & Systems, PHI, 2011.
3. B.P. Lathi, Principles of Linear Systems and Signals, Oxford University Press, 2nd Edition, 2013.

Online Resources/ Web Resources:

1. https://nptel.ac.in/courses/108/104/108104100/
2. https://nptel.ac.in/courses/117/104/117104074/#
3. https://eee.guc.edu.eg/Courses/Communications/COMM401%20Signal%20&%20System%20Theory/Alan%20V.%20Oppenheim,%20Alan%20S.%20Willsky,%20with%20S.%20Hamid-Signals%20and%20Systems-Prentice%20Hall%20(1996).pdf
4. https://books.google.co.in/books?id=MOVV94WUSlEC&printsec=frontcover#v=onepage&q&f=false
5. https://www.tutorialspoint.com/signals_and_systems/index.htm
6. https://www.wisdomjobs.com/e-university/signals-and-systems-tutorial-2419.html
7. http://bonnie.ece.gatech.edu/book/worked_problems.html
8. https://pages.jh.edu/~bcooper8/sigma_files/courses/214/signalsandsystemsnotes.pdf

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2503	**ANALOG ELECTRONICS LAB**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	0	0	3	36	1.5	40	60	100

Pre-requisite: Basic knowledge on amplifiers and oscillators.

Course Objectives:

1. Analyze amplifiers for frequency response
2. Analyze feedback circuits, amplifier circuits and oscillator circuits
3. Design and construct simple electronic circuits to accomplish a specific function, e.g., designing amplifiers

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

CO 1	Measure various parameters of analog circuits and compare experimental results in the laboratory with theoretical analysis. (BL-3)
CO 2	Analyze negative feedback amplifier circuits, oscillators, Power amplifiers, Tuned amplifiers.(BL-4)
CO 3	Design analog electronic circuits using discrete components (BL-3)
CO 4	Design RC and LC oscillators, Feedback amplifier for specified gain and multistage amplifiers for Low, Mid and high frequencies. (BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1				1					2	2				
CO2	3	2			2				2	2				2
CO3	3	2	2	2	2				2	2			2	2
CO4			2		2				2	2			2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
Task-1 : COMMON EMITTER AMPLIFIER	
Objective: Design voltage divider based Common Emitter amplifier with discrete components and calculate the bandwidth of amplifier from its frequency response.	CO1
Task-2: RC COUPLED AMPLIFIER	
Objective: Design two stage RC coupled amplifier for given specifications. Determine Gain and Bandwidth from its frequency response curve.	CO 1
Task-3: DARLINGTON AMPLIFIER	
Objective: Design Darlington amplifier and determine gain and bandwidth from frequency response. .	CO 2
Task-4: CASCODE AMPLIFIER	

Objective: Design cascode amplifier and determine gain and bandwidth from frequency response	
Task-5: VOLTAGE SERIES FEEDBACK AMPLIFIER	
Objective: Design voltage series feedback amplifier for the given specifications. Determine the effect of feedback on the frequency response of a voltage series feedback amplifier.	CO 2
Task-6 : CURRENT SHUNT FEEDBACK AMPLIFIER	
Objective: Design and simulate current shunt feedback using PSPICE/Multisim and determine the effect of feedback on the frequency response	CO 2
Task-9: RC PHASE SHIFT OSCILLATOR	
Objective: Design and simulate RC Phase shift oscillator for the given specification using PSPICE /Multisim. Determine the frequency of oscillation using simulation tool.	CO 2
Task-10 : HARTLEY OSCILLATOR	
Objective: Design and simulate Hartley oscillator using PSPICE /Multisim and determine the frequency of oscillations..	CO 2
Task-9: COLPITTS OSCILLATOR	
Objective: Design and simulate Colpitts oscillator using PSPICE /Multisim and determine the frequency of oscillations.	CO 4
Task-10: CLASS-A POWER AMPLIFIER	
Objective: Design and simulate class A power amplifier using PSPICE /Multisim, find out the efficiency and Plot the output waveforms.	CO 4
Task-11: CLASS-B PUSH PULL AMPLIFIER	
Objective: Design and simulate class B push-pull amplifier using PSPICE /Multisim, find out the efficiency and Plot the output waveforms.	CO 2
Task-12: SINGLE TUNED AMPLIFIER	
Objective: Design and simulate single tuned voltage amplifier using PSPICE /Multisim and determine the resonant frequency and bandwidth.	CO 2

Additional Experiments:	
Task-13: WEIN BRIDGE OSCILLATOR	
Objective: Design Wien bridge oscillator for the given specification. Determine the frequency of oscillation.	CO 3
Task-14 : CLASS C AMPLIFIER	
Objective: Design and simulate class C power amplifier using PSPICE /Multisim and find the efficiency and plot the output waveforms.	CO 3
Virtual Labs: 1. http://vlabs.iitkgp.ac.in/tcad/exp10/index.html# 2. http://vlab.amrita.edu/index.php?sub=1&brch=201	

Text Book(s):

1. Introduction to PSPICE Using OrCAD for Circuits and Electronics by Rashid Muhammad H
2. PSPICE and MATLAB for electronics: An integrated approach by John o. Attia
3. Fundamentals of Electronic Circuit Design, Getting Started: MultiSim Textbook Edition byDavid J. Comer, Donald T. Comer.

Reference Book(s):

1. A Guide to Circuit Simulation and Analysis Using PSPICE by Paul W. Tuinenga
2. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits Theory" Pearson/Prentice Hall, 9th Edition, 2006.
3. Sedra A.S. and K.C. Smith, "Micro Electronic Circuits", Oxford University Press, 5th Edition.

Web References:

1. https://nptel.ac.in/courses/122/106/122106025/
2. https://www.tutorialspoint.com/semiconductor_devices/index.htm
3. https://www.allaboutcircuits.com/textbook/semiconductors/

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2504	MATLAB AND SIMULINK LAB							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
IV	0	0	2	36	1	40	60	100

Pre-requisite: Knowledge on MATLAB Basics.

Course Objectives:

1. To provide practical exposure with generation and simulation of basic signals using standardized tools.
2. To analyze signals and sequences using Fourier, Laplace and Z-transforms.
3. To apply Matlab tools for writing programs.

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

CO 1	Demonstrate Operations on Matrices, Generation of Various signals and Sequences, Convolution and Correlation of signals and Sequences. (BL-2)
CO 2	Execute arithmetic operations on signals and sequences. (BL-2)
CO 3	Analyze the auto correlation and cross correlation of various signals. (BL-4)
CO 4	Estimate the frequency response of LTI systems using Fourier and Laplace transforms. (BL-4)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1							2				1	2
CO2	2	1							1				1	2
CO3	2	2	2	1					3				1	2
CO4	2	2	2	1					2				2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
Task-1: INTRODUCTION TO MATLAB	
Objective: To familiarize MATLAB Tool.	**CO1**
Task-2: OPERATIONS ON MATRICES	
Objective: To write a MATLAB program to perform various mathematical operations on matrices. A. Addition of two N×N matrices B. Subtraction of two N×N matrices C. Multiplication of two N×N matrices D. Inverse of a matrix E. Eigen values of a matrix	**CO 1**

Task-3: GENERATION OF SIGNALS AND SEQUENCES	
Objective: To write a MATLAB program to generate various signals and Sequences such as unit Impulse, Unit Step, Square, Sawtooth, Triangular, Sinusoidal, Ramp, sinc function.	CO 1
Task-4: OPERATIONS ON SIGNALS AND SEQUENCES	
Objective: To write a MATLAB program to perform various operations on signals and sequences such as A. Addition B. Multiplication C. Scaling D. Shifting E. Folding	CO 2
Task-5: ENERGY AND POWER OF A SIGNAL	
Objective: To write a MATLAB program to find Energy and power of a given signal.	CO 1
Task-6: CONVOLUTION AND CORRELATION OF SIGNALS AND SEQUENCES	
Objective: To write a MATLAB program to perform convolution and correlation of given signals and sequences using MATLAB.	CO 1
Task-7: FOURIER TRANSFORM OF A SIGNAL	
Objective: To write a MATLAB program to find the Fourier Transform of a Signal and plot its Magnitude and Phase Spectrum.	CO 3
Task-8: VERIFICATION OF LINEARITY AND TIME INVARIANCE PROPERTIES	
Objective: To write a MATLAB program to verify Linearity and Time Invariance properties of Continuous/Discrete Systems.	CO 4
Task-9: LAPLACE TRANSFORM OF CONTINUOUS SIGNAL	
Objective: To write a MATLAB program to find the Laplace transform of a signal.	CO 3
Task-10: Z-TRANSFORM OF DISCRETE SIGNAL	
Objective: To write a MATLAB program to find the Z-transform of a discrete signal.	CO 3
Task-11: GAUSSIAN NOISE	
Objective: To write a MATLAB program to generate Complex Gaussian noise and find its mean, variance, Probability Density Function (pdf) and Power Spectral Density (PSD)	CO 1
Task-12: VERIFICATION OF SAMPLING THEOREM	
Objective: To write a MATLAB Program to verify Sampling theorem	CO 4

Additional Experiments:	
Task-13: LOCATING ZEROS AND POLES	
Objective: To write a MATLAB program to Locate Zeros and Poles and plot in S-Plane or Z-	CO 3

Plane for the given Transfer Function.	

Task-14: DETECTION OF NOISE BY CORRELATION	
Objective: To write a MATLAB program to detect Noise by Auto Correlation / Cross correlation.	CO 1
Virtual Labs: 1.To represent discrete time signal and perform basic mathematical operations on DTS http://vlabs.iitb.ac.in/vlabs-dev/labs/mit_bootcamp/signals/labs/exp1/index.php 2.Signals and their properties http://ssl-iitg.vlabs.ac.in/Signals%20and%20their%20properties(objectives).html 3.Fourier analysis of signals http://ssl-iitg.vlabs.ac.in/Signals_exp3(objectives).html 4.System and their property http://ssl-iitg.vlabs.ac.in/Exp_2_Signals%20and%20their%20property(objectives).html 5.Analysis of LTI system response http://ssl-iitg.vlabs.ac.in/Signals%20and%20their%20properties%205(objectives).html 6.Sampling and signal Reconstruction http://ssl-iitg.vlabs.ac.in/Sampling%20and%20signal%20reconstruction%20(objective).html	

Text Book(s):

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, "Signals and Systems", 2ndEdition, PHI, 2009.
2.MATLAB for Beginners:A Gentle Approach,Petra Books,Peter I.Kattan, ISBN: 978-1438203096
3.Stormy Attaway, "Matlab: a Practical Introduction to Programming and Problem Solving", Elsevier.

Reference Book(s):

1.Signals & Systems Using MATLAB **Luis F. Chaparro and Aydin Akan,3rd Edition ,2019**
2. Signals & Systems Using MATLAB **Alan V. Oppenheim**, **Alan S. Willsky**, *MIT* **S. Hamid Nawab,2nd Edition ,1997**
3. Simon Haykin and Van Veen, "Signals & Systems", 2ndEdition, Wiley, 2005.
4. A. Anand Kumar, Signals & Systems, PHI, 2011.
5. B.P. Lathi, Principles of Linear Systems and Signals, Oxford University Press, 2nd Edition, 2013.
6.Signals and Systems, J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, TMH

Web References:

1..https://electrosome.com/signal-generation-in-matlab/
2.https://electrosome.com/signal-operations-in-matlab/
3.https://in.mathworks.com/help/signal/ug/linear-and-circular-convolution.html
4.https://in.mathworks.com/help/matlab/math/basic-spectral-analysis.html

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2008	ANALOG AND DIGITAL COMMUNICATION SYSTEMS							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3	0	0	48	3	40	60	100

Pre-requisites:

- ✓ Electronic Devices
- ✓ Signals and Systems
- ✓ Probability and Random Processes

Course Objectives:

1. To familiarize various modulation and demodulation techniques of analog communication systems.
2. To acquire knowledge on angle modulation and demodulation techniques.
3. To learn the function of various stages of AM, FM transmitters.
4. To summarize various baseband and carrier modulation techniques
5. To understand the concept of information theory and channel coding.

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

CO 1	Analyze the Analog modulation and demodulation systems BL4
CO 2	Verify the effect of noise on the performance of communication system BL2
CO 3	Analyze the various Digital modulation techniques BL4
CO 4	Apply the Amplitude, frequency and phase shift keying techniques BL3
CO 5	Make use of the different error control codes for efficient transmission BL3

CO-PO Mapping

CO	PO												PSO	
	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2										2	
CO2	3	3	3										1	
CO3	3	3	3										2	
CO4	3	3	2										1	
CO5	3	2	2										2	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	CONTINUOUS WAVE MODULATION	Hours:10

Introduction to communication systems, Need for modulation, Amplitude Modulation (AM): AM and its modifications – DSB, SSB, VSB, Frequency translation, Frequency Division Multiplexing (FDM).

Angle Modulation: Frequency Modulation (FM), Phase modulation, Nonlinear Effects in FM, Super heterodyne receiver.

At the end of the Module 1, students will be able to:

1. Explain the benefits and applications of modulation.(BL:2)

2. Describe the generation and detection of amplitude modulated signals.(BL:2)
3. Compare AM, DSB-SC, SSB-SC and VSB. (BL:2)

MODULE -2	**NOISE AND PULSE MODULATION**	**Hours:08**

Introduction to noise: Types of noise, Receiver model, Noise in AM, DSB, SSB, and FM Receivers, Pre-emphasis and De-emphasis in FM.

Introduction to pulse modulation: Sampling process, PAM, PWM and PPM-generation and detection**.**

At the end of the Module 2, students will be able to:

1. List the types of noise. (BL:1)
2. Define noise temperature, noise bandwidth and noise figure.(BL:2)
3. List the types of pulse modulation schemes.(BL:2)
4. Analyze time and frequency domain representation of narrowband noise.(BL:4)
5. Compare PAM, PWM, PPM. (BL:2)

MODULE-3	**SOURCE CODING SYSTEMS**	**Hours:10**

Comparison of analog and digital communication systems, Elements of digital communication system, Sampler, Quantization-types and Encoder, PCM, Differential PCM, Delta Modulation (DM), Adaptive DM, Time Division Multiplexing (TDM), Comparison of the above systems.

At the end of the Module 3, students will be able to:

1. Describe the elements of digital communications system. (BL:2)
2. Explain types of quantization techniques. (BL:2)
3. Differentiate PCM and DPCM. (BL:2)
4. Explain how different noises are eliminated in ADM?(BL:2)
5. Explain Time Division Multiplexing (TDM). (BL:4)

MODULE-4	**BAND-PASS DATA TRANSMISSION**	**Hours:10**

Introduction, Need for carrier modulation techniques, Binary shift keying: ASK, FSK, PSK, DPSK generation, Coherent and non coherent detection, Band width, Signal space diagram, Probability error calculation, M-ary shift keying: ASK, FSK, PSK, Quadrature Amplitude Modulation (QAM), Minimum Shift Keying (MSK).

At the end of the Module 3, students will be able to:

1. Explain the need for carrier modulation techniques. (BL:2)
2. Differentiate coherent and non-coherent detection. (BL:2)
3. Analyze carrier modulation techniques. (BL:4)
4. Explain Quadrature Amplitude Modulation. (BL:2)

MODULE-5	**INFORMATION THEORY & CHANNEL CODING**	**Hours:10**

Information theory: Message, Information, Entropy, Mutual information & its properties, Channel capacity, Shannon Hartley Theorem, Shannon Fano & Huff man coding and Illustrative problems.

Channel Coding: Error detection & correction - Repetition & Parity check codes, Interleaving, Code vectors and Hamming distance, FEC and ARQ systems, Linear block codes – Matrix representation of block Codes, Convolutional codes, Viterbi decoding.

At the end of the Module 5, students will be able to:

1. Define information. (BL:1)
2. Explain the types of entropies and its properties. (BL:2)
3. Discuss source coding theorem.(BL:2)Explain the concept of frequency interleaving. (BL:2)
4. Analyze channel coding techniques. (BL:4)

Term work:

- Design and simulate modulation and demodulation circuits using MATLAB Simulink.

Content beyond syllabus:

Advanced Communication Systems.

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	DSB-SC	CO1	https://www.youtube.com/watch?v=OC451cdFLoQ
2	Pre-emphasis and De-emphasis circuits	CO2	https://youtu.be/OUrp4unGeDg
3	Noise Analysis of SSB-SC	CO3	https://youtu.be/3dGEk5bzNoc
4	Time Division Multiplexing	CO4	https://www.youtube.com/watch?v=7JXkqSLc18g
5	Quadrature Amplitude Modulation	CO5	https://www.electronics-notes.com/articles/radio/modulation/quadrature-amplitude-modulation-what-is-qam-basics.php
6	Forward Error Correction (FEC) Systems	CO5	https://www.tutorialspoint.com/forward-error-correction-fec

Text Book(s):

1. Simon Haykin, "Communication Systems", JohnWiley& Sons, 4th Edition, 2004.
2. B. P. Lathi, Zhi Ding " Modern Digital and Analog Communication Systems", Oxford press, 2011

Reference Book(s):

1. Sam Shanmugam, "Digital and Analog Communication Systems",JohnWiley& Sons, 1999.
2. Bernard Sklar, F. J. harris"Digial Communications: Fundamentals and Applications", Pearson Publications, 2020.
3. Taub and Schilling, "Principles of Communication Systems", Tata McGraw Hill, 2007

Online Resources:

1. https://nptel.ac.in/courses/117/105/117105143/
2. https://nptel.ac.in/courses/117/101/117101051/
3. https://www.udemy.com/course/analog-communication/
4. https://www.tutorialspoint.com/analog_communication/index.htm
5. https://www.classcentral.com/course/swayam-analog-communication-13893
6. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-450-principles-of-digital-communications-i-fall-2006/video-lectures/
7. https://nptel.ac.in/courses/117/101/117101051/
8. https://swayam.gov.in/NPTEL
9. https://nptel.ac.in/courses/117/105/117105143/
   https://nptel.ac.in/courses/117/105/117105144/

Web References:

1. https://www.youtube.com/watch?v=S2vzyk6BXtA (Square law modulator for AM Generation)
2. https://www.youtube.com/watch?v=Q5dC9TbzR9k (Phase Locked Loop)
3. https://www.youtube.com/watch?v=zy4DlBYjnFM (Frequency Division Multiplexing)
4. https://www.youtube.com/watch?v=GzWVeiX9ohk (Matched Filter)
5. https://www.youtube.com/watch?v=ij760lCUtfw (QPSK)
6. https://www.youtube.com/watch?v=dTPzZ3X-wLA (Linear Block Codes)
7. https://www.tutorialspoint.com/analog_communication/analog_communication
8. https://www.sciencedirect.com/topics/engineering/analog-communication
9. http://complextoreal.com/tutorials/
10. https://www.tutorialspoint.com/digital_communication/digital_communication_digital_modulation_techniques.htm
11. https://www.electronicdesign.com/technologies/communications/article/21798737/understanding-modern-digital-modulation-techniques
12. https://www.tutorialspoint.com/principles_of_communication/principles_of_communication_noise.htm

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2009	**Linear IC Applications**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3	0	0	48	3	40	60	100

Pre-requisite: Basic knowledge of Electronic Devices, EDC and Digital Logic Design.

Module 1	Module 2	Module 3	Module 4	Module 5	Total hours
10	09	10	09	10	48

Course Objectives:

1. Explain the differential amplifier and its electrical parameters.
2. To introduce the basic building blocks of operational Amplifier.
3. To study and design various applications of OPAMPs.
4. To know the design of oscillators and Active filters using op amps.
5. To Study the concepts of the waveform generation, converters and introduce some special function Ics (i.e., IC 555 Timer, IC 565 PLL).

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

CO 1	Analyze the various characteristics of Differential amplifier. (BL: 4).
CO 2	Interpret the characteristics and configurations of Op-amp (BL: 2).
CO 3	Analyze the linear and nonlinear applications of an Op-amp (BL:2)
CO 4	Design the Oscillators and active filters using Op-amp (BL: 4).
C0 5	Study the applications of the special purpose integrated circuits and Data Convertors. (BL: 2).

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	3	3	3											
CO2	3	3	2											
CO3	3	3	3		1								1	1
CO4	3	3	2		2								2	2
CO5	3	3	2		2								2	1

COURSE CONTENT

MODULE-1 **Integrated Circuits and Differential Amplifier** **10hours**

Introduction to IC, Classification of IC's, Differential amplifier, Differential Amplifier Circuits Configurations, DC and AC analysis of Dual input balanced/unbalanced and single input balanced/unbalanced output configurations, Properties of the differential Amplifier circuit configurations, Methods of improving CMRR - Constant Current Bias and Current mirror, Level Translator. (10 hrs)

At the end of the Module 1, students will be able to: 1. Infer the Dc and AC Analysis of BJT Differential AmplifierConfigurations.(BL2) 2. Choose the Different methods to improve CMRR in Differential amplifier.(BL2) 3.Illustrate the use of level translator in differential amplifier.(BL2)				
MODULE – 2	**Operational amplifiers & OP-AMP Configurations**		**9hours**	
Introduction, Basic information of Op-Amp, Block diagram of an Op-Amp, Ideal and Practical Op-Amp Characteristic's, Ideal Equivalent Circuit of an Op-Amp, Ideal and Practical Voltage Transfer curve, DC and AC characteristics of Op-Amp.(5hrs). Introduction,feedbackconfigurations,voltage series feedback, voltage shunt feedback and differential amplifiers, Frequency response, High frequency Op-Amp equivalent circuit, open loop gain Vs frequency, circuit stability, slew rate. (5hrs).				
At the end of the Module 2, students will be able to: 1.Demonstrate the Op-Amp with negative and positive feedback.(BL2) 2. Outline the Gain Bandwidth Concept and the frequency response of the amplifiers. (BL2) 3.Illustrate various stages of operational amplifier(BL2) 4.Infer how to draw the ideal and practical Op-Amp Voltage Transfer Curve.(BL2) 5.Illustrate the DC and AC characteristics of an Op-Amp.(BL2)				
MODULE -3	**OP-AMP APPLICATIONS**		**10hours**	
DC and AC amplifiers, Summing Amplifiers,instrumentation amplifier, voltage to current converter, current to voltage converter, Integrator, Differentiator , Comparator , zero crossing detector, Schmitt Trigger, Square wave generator, triangular wave and Saw-tooth wave form generators.(10 hrs)				
At the end of the Module 3, students will be able to: 1.Design Circuits using Operational Amplifiers for various applications.(BL3) 2.Illustrate the various types of Wave forms as sine wave, square, triangular and Saw-tooth wave forms.(BL2) 3.Summarize the linearICapplicationshelpinICBasedElectronicProjectsDesign.(BL2)				
MODULE-4	**Oscillators& Active Filters**		**9hours**	
RC Phase shift and Weinbridge oscillators, Active filters: Classification of Filters, 1st and 2nd order LPF & HPF filters, Band pass, Band reject and All pass filters.(9 hrs)				
At the end of the Module 4, students will be able to 1. Demonstrate the basic operating principles of oscillator.(BL2) 2. Illustrate the various types of Filters. (BL2) 3. Explain First order Low Pass filter with Circuit diagram.(BL2)				
MODULE-5	**Specialized applications**		**10hours**	
555 timer IC (Mono-stable& Astable operation) & its applications, PLL, operating principles, Monolithic PLL, applications.(5 hrs) Introduction, Basic DAC techniques, Binary Weighted Resistor DAC, R-2R Ladder DAC, Inverted R-2R DAC, D/A Specifications, A/D Converters - Flash type, Successive Approximation type, Dual Slope type, A/D Specifications.(5 hrs)				
At the end of the Module 5, students will be able to: 1.Demonstrate the operating principles of IC 555 timer, IC PLL and applications.(BL2)				

2.Explain the operating principle of PLL with block diagram(BL2) 3.Summarize the Performance of the D to A and A to D converters.(BL2) 4. Demonstrate the Switches for D/A converters. (BL2) 5.Choose appropriate A/D and D/A converters for signal processing applications.(BL2)	
1: Low, 2-Medium, 3- High	

Term work:

Construct circuits using different linear ICs and verify their outputs using simulation software.

Content beyond syllabus:

1. Introduction to TL082
2. 723 Voltage regulator
3 Fixed voltage regulators

Self-Study:

Contents to promote self-Learning:

SNO	Topic	Reference
1	Integrated Circuits &Differential Amplifiers	1. https://www.youtube.com/watch?v=bTsMRtftrK8&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=23&t=0s (Integrated Circuits) https://www.youtube.com/watch?v=8VUBnkUcUtE (Differential amplifiers) https://www.youtube.com/watch?v=QzeH0exPi-c&list=PLB9Enjz2xxTqsgE2Wwoqclj0iA2TV9QxZ&index=29 (DC Analysis of DIBO) https://www.youtube.com/watch?v=9Zp6Uk0YsIU&list=PLB9Enjz2xxTqsgE2Wwoqclj0iA2TV9QxZ&index=19M(DIBO-Gain) https://www.youtube.com/watch?v=B9PJsJsK3mk (Current Mirror) https://www.youtube.com/watch?v=rxKXcth8ZVM&list=PLB9Enjz2xxTqsgE2Wwoqclj0iA2TV9QxZ&index=18 (DIBO-Resistanc)
2	Operational Amplifiers and Configurations	1. https://www.youtube.com/watch?v=BixWPRNuH9M&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=1(Operational Amplifier) 2. https://www.youtube.com/watch?v=jaD8VMjpjS4&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=9(Differential Amplifier) 3. https://www.youtube.com/watch?v=eIby2FWBkeE&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=8(DC Characteristics) 4. https://www.youtube.com/watch?v=uVr0UaRPpGY&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=7(AC Characteristics) 5. https://www.youtube.com/watch?v=r11lwWyumu8&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=6(Voltage series feedback amplifier) 6. https://www.youtube.com/watch?v=3Wd6sWIH2vU&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=5 (Voltage shunt feedback amplifier)

		7. https://www.youtube.com/playlist?list=PLm_MSClsnwm91RcONokvGw2dRxG-s_nM- https://www.youtube.com/playlist?list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh
3	Applications of Op-Amps	1.https://www.youtube.com/watch?v=Pfn2aOnW8yo&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=4(Instrumentation Amplifier) 2.https://www.youtube.com/watch?v=sz6OyNG2Nm0&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=11 (Operational Amplifier Applications& Filters) https://www.youtube.com/watch?v=4DgnGoGiYew&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=20 (Comparators) https://www.youtube.com/watch?v=PYEOTiU6qQg&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=16 (Sample &Hold,Schmitt Trigger) https://www.youtube.com/watch?v=J_rLtPiu7kI&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=17 (Multivibrators) https://www.youtube.com/playlist?list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh
4	Oscillator & Active Filters.	https://www.youtube.com/watch?v=M3yI0byaqKc&list=PL1hqL6v9rNg4tKlAW7p4vn26yRyu8XdfJ&index=28&t=0s (Introduction to Oscillator) https://www.youtube.com/watch?v=8eLoIUGSXns&list=PL1hqL6v9rNg4tKlAW7p4vn26yRyu8XdfJ&index=28 (RcPhas shift Oscillator) https://www.youtube.com/watch?v=YH1zbPA_i2Y (Wein bridge Oscillator-NPTEL). https://www.youtube.com/watch?v=YZnd4lJBa0I&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=14 (First order Filters) https://www.youtube.com/watch?v=uj4b2O4XVVE&list=PL1hqL6v9rNg4tKlAW7p4vn26yRyu8XdfJ&index=26 (Band Pass and Band Reject Filters)
5	Specialized Applications	https://www.youtube.com/watch?v=CGj8YpEn9iU&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=10 (555 Timers) https://www.youtube.com/watch?v=CGj8YpEn9iU&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=10 (PLL & VCO) https://www.youtube.com/watch?v=-FPiAjbJmPI&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=21 (PLL Applications) https://www.youtube.com/playlist?list=PLm_MSClsnwm91RcONokvGw2dRxG-s_nM-
		https://www.youtube.com/watch?v=86gPOMaZQCs&list=PLClvmlKio9stZC5Fxglq-_Tr5Z_oMQZkh&index=19 (A/D and D/A Converters)

Text Book(s):

1. Ramakanth A. Gayakwad, "Op-Amps & Linear ICs", 4th Edition, PHI, 2002
2. Choudhary D. Roy,Shail B. Jain, Linear Integrated Circuits, New Age International (p) Ltd, (2018-19 Session),5th Edition (Paperback)

Reference Book(s):

1.Analog Electronics, L.K.Maheshwari, Laxmi Publications,PHI,2005

2. D.A. Bell, Operational Amplifiers and Linear ICs. Oxford University Press, 3rd edition.
3. R.F.Coughlin& Fredrick Driscoll"Op-Amps & Linear Integrated Circuits"6th Edition, PHI.
4.F. Sergio, Design with Op Amps & Analog Integrated Circuits. Mcgraw Hill ,1997
5. D. William, Operational Amplifiers with Linear Integrated Circuits. Prentice Hall, 2004
6. Analog Electronics, I.G.Nagrath, PHI 2 **edition** (13 September 2013)

7. K.LalKishore, "Operational Amplifiers and Linear Integrated Circuits", Pearson Education India, 2009.

Online Resources:

1.https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/video-lectures/lecture-20/-Op-Amps
2. https://www.youtube.com/watch?v=EGmreVQ-yNM-555 Timer
3. https://www.youtube.com/watch?v=Q5dC9TbzR9k-PLL
4. https://www.youtube.com/channel/UCsnMUwuYBQPFND6C_ybc9-g/videos
5. https://www.youtube.com/watch?v=l6MkYKdkDkw-Integrated Circuits
6.https://www.youtube.com/playlist?list=PLXMC-WkvZqjPnkYMaTtTTf_JhFbPR2MQa-IC555-DAC-ADC
7.https://www.youtube.com/playlist?list=PLnPkMfyANm0xpPD56ExVw8FEocT29wmIj-Integrated Circuits and applications
8. https://www.youtube.com/watch?v=BVJ7ri-vDh4-Digital Logic Families
9. https://www.youtube.com/watch?v=lxjauuQnWmE-Second order Active filters
10https://www.youtube.com/playlist?list=PLnPUHuqVn2sddfG-BFFHe25ZBtS5PxTi6
11https://www.youtube.com/watch?v=8VUBnkUcUtE-Differential Amplifier DC and Ac analysis
12.https://www.youtube.com/watch?v=QsxN1VWBXps&list=PLPHhJ2jrOrwxBOZrM4-xMxT3St2eYK3YY&index=2&t=0s_Linear Integrated Circuits
13.https://www.youtube.com/playlist?list=PL4BY6TEAkoMvdIikr2NGLnuuGhctgosnQ-Linear Integrated Circuits

Web References:

1. https://www.tutorialspoint.com/linear_integrated_circuits_applications/index.htm
2.https://books.google.co.in/books/about/Linear__Integrated__Circuits html? id=aByz—9D63wC
3. https://nptel.ac.in/courses/117/107/117107094/
4. https://www.oreilly.com/library/view/linear-integrated-circuit9789332558250/
5.http://www.nptel.ac.in/courses/Webcourse-contents/IITROORKEE/Analog%20circuits/index.htm

6.https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits

and-electronics-spring-2007/

NARAYANA ENGINEERING COLLEGE: NELLORE								
20EC2010	MICROPROCESSORS AND MICROCONTROLLERS							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	3	0	0	48	3	40	60	100

Pre-requisite: Knowledge on switching theory and logic design, basics of computer organisation, architecture and basic programming techniques.

Course Objectives:

1. To study the internal architecture, interrupts & memory organization of 8086 microprocessor.
2. To understand the programming concepts using 8086.
3. To impart the basics of the MSP 430 and its variants.
4. To understand programming techniques using interrupts, instruction set & addressing modes
5. To provide the knowledge on low power modes of MSP 430.

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

CO 1	Interpret the working principles of 8086 micro processor . (BL-2)
CO 2	Develop assembly language programs using instruction set in 8086 microprocessor. (BL-3)
CO 3	Compare various versions of MSP430 based on applications. (BL-2)
CO 4	Summarize the interrupt types, addressing modes & memory organization of MSP430. (BL-2)
CO 5	Implement serial communication protocols using MSP430. (BL-3)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1		1										1	
CO2	2	2		1	2									1
CO3	1	1	1										1	2
CO4	2	2	1	1	2									1
CO5	1		1	1	1								1	

1: Low, 2-Medium, 3- High

-COURSE CONTENT

MODULE – 1	8086 MICROPROCESSOR	10 h

Introduction, Microprocessor Evolution, Intel 8086 Microprocessor: Features block diagram, Register Organization, Memory organization, Interrupts and Interrupt Vector Table.

At the end of the Module 1, students will be able to:

1. List the features of 8086 microprocessor.(BL-1)
2. Explain the architecture of 8086 microprocessor.(BL-2)
3. Describe the memory organization of 8086 microprocessor.(BL-1)
4. Explain the concept of interrupt handling of 8086.(BL-2)

MODULE 2	PROGRAMMING WITH 8086	10 h

Instruction Formats -Addressing Modes-Instruction Set of 8086, Assembler Directives, Macros and Procedures. Simple ALP's.

MODULE-3	LOW POWER RISC MSP430	10 h

Low power RISC MSP430 block diagram, features and architecture, Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, Register set.

At the end of the Module 3, students will be able to:

1. List the features of MSP 430 microcontroller.(BL-1)
2. Explain the architecture of MSP 430 microcontroller.(BL-2)
3. Compare variants of MSP 430. (BL-2)

MODULE-4	ADDRESSING MODES & INTERRUPTS OF MSP430	8 h

Addressing modes, Instruction set, Memory address space; I/O ports pull up/down resistors concepts, Interrupts and interrupt programming.

At the end of the Module 4, students will be able to:

1. Apply data in MSP 430 programming using addressing modes. (BL-3)
2. Explain the instruction set of MSP 430. (BL-2)
3. Do programming using interrupts.(BL-3)
4. Lists interrupt types supported by MSP430. (BL-2)

MODULE-5	ON-CHIP PERIPHERALS OF MSP 430	10 h

On-chip peripherals (Analog & Digital), ADC, Comparator and data transfer using DMA controller, Watchdog timer, System clocks, Timers &Real Time Clock (RTC), Low power modes. Serial Communication Protocols: UART, USB, I2C & SPI and implementation using MSP430.

At the end of the Module 5, students will be able to:

1. List the on chip peripherals of MSP 430 microcontroller.(BL-1)
2. Discuss MSP430 clock system. (BL-2)
3. Explain the operation of watchdog timer.(BL-2)
4. Explain the concept of Real Time Clock (RTC). (BL-2)
5. List the features of UART, USB, SPI, and I2C. (BL-1)
6. Explain the UART, I2C, SPI interface using MSP430. (BL-2)

Total hours:	**48 Hours**

At the end of the Module 2, students will be able to:

1. Explain the different addressing modes in 8086. (BL-2)
2. Explain different instruction set of 8086 (BL-2)
3. Implement ALPs using 8086 (BL-3)

Content Beyond syllabus:

1. ARM processor architecture: Features, Block diagram, pin diagram.
2. TIVA controller architecture: Features, Block diagram, pin diagram.

Self-Study:

Contents to promote self-Learning:

S.No	Module	Reference
1	8086 processor	https://electronicsdesk.com/8086-microprocessor.html https://circuitglobe.com/difference-between-8085-and-8086-

		microprocessor.html
2	Programming With 8086	http://www.ee.hacettepe.edu.tr/~alkar/ELE414/dirz2005/w6-414-[2005].pdf
3	Low Power RISC MSP 430	http://www.ece.utep.edu/courses/web3376/Notes_files/ee3376-isa.pdf
4	Addressing modes & interrupts of MSP430	https://cnx.org/contents/__auotnt@1/Addressing-modes
5	On chip peripherals	http://learncontrollers.blogspot.com/2018/02/timer-of-msp430.html https://www.ti.com/lit/ml/slap117/slap117.pdf

Text Book(s):

1. "Microprocessor and Microcontrollers", N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Oxford Publishers. Second Edition, 2016
2. MSP430 microcontroller basics. John H. Davies, Newnes Publication, I st Edition, 2008
3. "The X86 Microprocessors , Architecture, Programming and Inerfacing" , Lyla B.Das ,Pearson Publications,2010

Reference Book(s):

1. Advanced microprocessors & microcontrollers", K M Burchandi & A K Ray, 3 rd edition, 2013
2. "Microprocessor and Interfacing: Programming and Hardware", Douglas V.Hall, McGrawHill
3. "8086 microprocessor: Programming and Interfacing the PC", Kenneth Ayala Cengage Learning.

Online Resources / Web References:

1. https://nptel.ac.in/courses/108/103/108103157/
2. https://training.ti.com/msp430-ultra-low-power-microcontroller-overview
3. https://www.tutorialspoint.com/microprocessor/index.htm
4. http://www.te.kmutnb.ac.th/~ptt/lectures/01_Microprocessors/03_MSP430/05_Tutorialv0_3.pdf

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2505	ANALOG AND DIGITAL COMMUNICATIONS LAB							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	0	0	3	36	1.5	40	60	100

Pre-requisite: A course on Analog and Digital Communications.

Course Objectives:

1. To design and test communication circuits for analog modulation and demodulation schemes.
2. To familiarize the concept of antenna parameters and their measurement process.
3. To design and test digital modulation and demodulation techniques.
4. To write and execute programs in MATLAB to implement various modulation techniques.
5. To understand channel coding and equalization technique

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

CO 1	Experiment with various analog modulation and demodulation techniques
CO 2	Analyze different pulse modulation techniques.
CO 3	Analyze digital modulation & demodulation techniques.
CO 4	Simulate digital modulation & demodulation techniques using MATLAB.

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2						2	2		2	3	3
CO2	3	3							2	2		2	3	3
CO3	3	3	2						2	2		2	3	3
CO4	3	3	2						2	2		2	2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
Task-1: AMPLITUDE MODULATION AND DEMODULATION	
Objective: To study the function of Amplitude Modulation & Demodulation (under modulation, perfect modulation & over modulation) and also to calculate the modulation index.	CO 1
Task-2: FREQUENCY MODULATION AND DEMODULATION	
Objective: To study the functioning of Frequency Modulation & Demodulation and to calculate the modulation index.	CO 1
Task-3: PULSE AMPLITUDE MODULATION & DEMODULATION	

Objective: To Perform Pulse amplitude Modulation and Demodulation and to draw the observed waveforms.	CO 2
TASK-4: PULSE WIDTH AND POSITION MODULATION & DEMODULATION	
Objective: To implement the Pulse Width and Position Modulation& Demodulation circuits and to draw the observed waveforms.	CO 2
Task-5: PRE-EMPHASIS AND DE-EMPHASIS	
Objective: To study the functioning of Pre-Emphasis and De-Emphasis circuits.	CO 1
Task-6: PULSE CODE MODULATION AND DEMODULATION	
Objective: To Study & Understand the operation of the Pulse code modulation & Demodulation.	CO 2
Task-7: DIFFERENTIAL PULSE CODE MODULATION AND DEMODULATION	
Objective: To generate the differential Pulse code modulation & Demodulation using MATLAB	CO 2
Task-8: DELTA MODULATION AND DEMODULATION	
Objective: To transmit an analog message signal in its digital form and again reconstruct back the original analog message signal at receiver by using Delta modulator.	CO 2
Task-9: HUFFMAN CODING	
Objective: To generate Huffman coding using Matlab.	CO 3
Task -10: FSK MODULATION AND DEMODULATION	
Objective: To generate and demodulate frequency shift keyed (FSK) signal using MATLAB.	CO 3
Task-11: PSK MODULATION AND DEMODULATION	
Objective: To generate and demodulate phase shift keyed (PSK) signal using MATLAB	CO 3
Task-12: GENERATION OF QPSK USING MATLAB	
Objective: To generate and demodulate Quadrature phase shift keyed (QPSK) signal using MATLAB.	CO 3

Additional Experiments:	
Task-13: FREQUENCY DIVISION MULTIPLEXING USING MATLAB	
Objective: To study and simulate Frequency division multiplexing and draw its waveforms.	CO 4
TASK-14: CHANNEL EQUALIZATION ALGORITHM USING MATLAB	

Objective: To simulate the Zero Forcing Equalizer.	CO 4

Tools / Equipment Required:

1 Regulated Power Supply (0-30) V
2. CROs (0-20)MHz
3. Function Generators (0-3) MHz
4. RF Signal Generators (0-1000) MHz
5. Multimeters
6. Required Electronic components(active and passive)for the design of experiments from 1 -7
7. Radio Receiver Demo kits or Trainers.
8. RF power meter frequency range 0 – 1000MHz
9. Spectrum Analyzer
10. RPS - 0 – 30 V
11. CROs - 0 – 20 M Hz.
12. Function Generators - 0 – 1 M Hz
13. RF Generators (3 Nos.) 0 – 1000 M Hz.
14. Multimeters
15. Lab Experimental kit for Pulse Code Modulation (Experiment No.3 of part –A)
16. Required Electronic Components (Active and Passive) which include required ICs
17. Arbitrary Wave form generators/ PNS generators – 2 Nos. (to generate digital data at required data rates)
18. Licensed MATLAB software for 30 users with required tool boxes.

Virtual Labs:

https://www.etti.unibw.de/labalive/index/analogmodulation/
http://vlab.amrita.edu/index.php?sub=59&brch=163
https://www.etti.unibw.de/labalive/index/digitalmodulation/
http://vlab.amrita.edu/index.php?sub=59&brch=163

Self-Study:

Contents to promote self-Learning:

S.NO	Topic	CO	Reference
1	Amplitude modulation and demodulation	CO 1	https://youtu.be/cfwwxYvUYEg
2	Pre-emphasis and De-emphasis circuits	CO2	https://youtu.be/OUrp4unGeDg
3	Delta modulation and demodulation	CO 3	https://youtu.be/lBZrY7r5TRo
4	Digital keying techniques	CO4	https://www.youtube.com/watch?v=gmDBP-1QtiQ
5	Huffman coding using MATLAB	CO 5	https://youtu.be/uTdBFr8Fn-w

Text Book(s):

1. B. P. Lathi, "Modern Digital and Analog Communication Systems," 3rd Edition, Oxford Univ. press, 2006.
2. John Wiley & Sons Simon Haykin, "Communication Systems,",3rd Edition, 2010.
3. Sham Shanmugam, "Digital and Analog Communication Systems", Wiley-India edition, 2006.(edition)
4. R.P. Singh and S. Sapre, "Communication Systems: Analog and Digital", 3rd edition, Tata McGraw-Hill, 2017.
5. J.S. Chitode, "Digital Communication:, Technical Publications, Pune.

Reference Book(s):

1. Bruce Carlson, & Paul B. Crilly, "Communication Systems – An Introduction to Signals & Noise in Electrical Communication", 5th Edition, McGraw-Hill International Edition, 2010.
2. Herbert Taub & Donald L Schilling, "Principles of Communication Systems", 3rd Edition, Tata McGraw- Hill, 2009.
3. George Kennedy and Bernard Davis, "Electronics & Communication System", TMH, 2004.(edition).
4. Digital communications, 5/e,2008,J G Proakis, McGraw Hill, New delhi.
5. Digital communications, 2/e, 2007, Bernard Sklar,Pearson edition, New delhi.

Web References:

1. https://www.youtube.com/watch?v=S2vzyk6BXtA (Square law modulator for AM Generation)
2. https://www.youtube.com/watch?v=Q5dC9TbzR9k (Phase Locked Loop)
3. https://www.youtube.com/watch?v=zy4DlBYjnFM (Frequency Division Multiplexing)
4. https://www.youtube.com/watch?v=ij760lCUtfw (QPSK)
5. https://www.youtube.com/watch?v=dTPzZ3X-wLA (Linear Block Codes)
6. https://www.tutorialspoint.com/analog_communication/analog_communication
7. https://www.sciencedirect.com/topics/engineering/analog-communication
8. http://complextoreal.com/tutorials/
9. https://www.tutorialspoint.com/digital_communication/digital_communication_digital_modulation_techniques.htm
10. https://www.electronicdesign.com/technologies/communications/article/21798737/understanding-modern-digital-modulation-techniques
    https://www.tutorialspoint.com/principles_of_communication/principles_of_communication_noise.htm

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2506	**MICROPROCESSORS & MICROCONTROLLERS LAB**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
V	0	0	3	36	1.5	40	60	100

Pre-requisite: Knowledge in C language

Course Objectives:

1. To gain knowledge on various tools for applying it to perform a specific task with microprocessors & microcontrollers.
2. To prepare students for developing of real time embedded systems.
3. To prepare students for project management.

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

CO 1	Execute assembly language programs using 8086 microprocessor.
CO 2	Examine interfacing and programming GPIO ports in C using MSP430.
CO 3	Design and implement MSP430 microcontroller based systems.

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2			2					1	1			1
CO2		2	2		2							2	1	1
CO3		2	2		2							2		1

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
PART-A: 8086 Microprocessor Programs using MASM/8086 microprocessor kit.	
Task 1 : Arithmetic operations	
Objective: Use Assembly language programming to perform arithmetic operations such as A. Addition of N 16-bit numbers B. Subtraction of N 16-bit numbers C. 8-bit by 8-bit multiplication operation D. 16-bit by 16-bit multiplication operation E. Unsigned division operation F. Signed division operation	CO 1
Task 2: Logical operations	
Objective: Use Assembly language programming to perform bit by bit logical operations such as A. AND, OR, NOT & XOR operations of two 8-bit numbers B. Shift & Rotate operations	CO 1
Task 3: String operations	

Objective: Use Assembly language programming to perform various string operations such as A. Move a block of string byte B. Compare two strings C. Reverse of a string D. Find length of a string	CO 1
Task 4 : Code Converters	
Objective: Use Assembly language programming to convert one form of binary code into another form such as A. BCD to ASCII code conversion B. Packed BCD to unpacked BCD	CO 1
PART-B: Embedded C Experiments using MSP430 Micro-controller	
Task 5 : Introduction to MSP430 launch pad and Programming Environment.	
Objective: Demonstrate MSP EXP430G2 launch pad & Code Composer Studio (CCS) to develop programs.	CO 2
Task 6 : Interfacing and programming GPIO ports	
Objective: Interfacing and programming GPIO ports in C using MSP430. 1. Blinking LEDs individually (Red / Green) 2. Blinking LEDs together (Red& Green) 3. Blinking LEDs alternately (Red& Green)	CO 3
Task 7: Read input from switch & glow LED	
Objective: Blink the onboard, GREEN / RED LED (connected to P1.0) whenever button (connected to P.1.1) is pressed and OFF when released using GPIO.	CO 3
Task 8: Configure Timer Block for Signal Generation	
Objective: Signal generation using interrupt programming technique.	CO 3
Task 9: Interrupt programming	
Objective: Interrupt programming examples through MSP430 GPIOs.	CO 3
Task 10: Interfacing potentiometer	
Objective: Interfacing potentiometer with MSP430 to check the operation based on applied resistance.	CO 3
Task 11: Configure Watchdog Timer In Watchdog Mode & Interval Mode	
Objective: Configure watchdog timer module in watchdog and Interval time mode and observe its output	CO 3
Additional Experiments:	
Task 12: PWM generation	
Objective: Pulse Width Modulated signal generation using timer on MSP430 GPIO.	CO 3
ADDITIONAL EXPERIMENTS	
Task 13: Programming with 8086 microprocessor	
Objective: Use assembly language programming to perform rotate operations with 8086 microprocessor.	CO 1
Task 14: Programming to find factorial of given number	

Objective: Use assembly language programming to find factorial of given 8-bit number using procedures with 8086 microprocessor.	CO1
Virtual Labs: **1.** http://vlabs.iitb.ac.in/vlabs-dev/labs_local/microprocessor/labs/explist.php **2.** https://github.com/jishanshaikh4/Microprocessor-Virtual-Lab **3.** http://www.msec.ac.in/pages/view/mpl	

Self-Study:

Contents to promote self-Learning:

SNO	Topic	Reference
1	MASM	https://www.youtube.com/watch?v=m4Cxi8qhKd4
2	Assembly language programming with emulator 8086	https://www.youtube.com/watch?v=zEuvNYe7WG0
3	MSP430 launchpad	https://www.youtube.com/watch?v=V0GrBUbomDA

Text Book(s):

1. "Microprocessor and Microcontrollers", N. Senthil Kumar, M. Saravanan, S. Jeevanathan, Oxford Publishers. 1 st Edition, 2010
2. MSP430 microcontroller basics. John H. Davies, Newnes Publication, I st Edition, 2008
3. Advanced microprocessors & microcontrollers", A K Ray, K M Burchandi 2nd edition.

Reference Book(s):

1. Introduction to Assembly Language Programming From 8086 to Pentium Processors by Dandamudi, Sivarama P.
2. "The X86 Microprocessors , Architecture, Programming and Inerfacing" , Lyla B.Das ,Pearson Publications,2010
3. "8086 microprocessor: Programming and Interfacing the PC", Kenneth Ayala, Cengage Learning

Web References:

1. https://www.geeksforgeeks.org/assembly-language-program-8086-microprocessor-divide-16-bit-number-8-bit-number/?ref=lbp
2. https://www.elprocus.com/8086-assembly-language-programs-explanation/
3. https://processors.wiki.ti.com/images/5/52/03_-_MSP430_Programming.pdf
4. https://www.accessengineeringlibrary.com/content/book/9780071830034/chapter/chapter6
5. http://209.211.220.205/vlabiitece/mi/labsMI.php
6. https://www.srmist.edu.in/content/microprocessor-lab-1

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2011	**Digital Design using HDL**							R20
Semester	**Hours / Week**			Total hrs	Credit	Max Marks		
	L	**T**	**P**		C	CIE	SEE	TOTAL
VI	**3**	**0**	**0**	48	3	40	60	100
Pre-requisite: Concepts of Switching Theory and Logic Design.								

Course Objectives:

1. To describe, design, and simulate digital circuits using the Verilog Hardware description language.
2. To understand behavioural and RTL modelling of digital circuits
3. To verify timing constraints of digital circuits, through the Verilog HDL
4. To synthesize, digital circuits designs on a development board
5. To Implement digital circuits on a development board

Course Outcomes: After successful completion of the course, the student will be able to:	
CO 1	Interpret digital design flow used in chip design Flow. (BL-2)
CO 2	Model simple digital circuits using Verilog HDL. (BL-3)
CO 3	Simulate digital circuits using Verilog HDL.(BL-3)
CO 4	Analyze simulation techniques in behavioral and Switch level models of digital circuits. (BL-3)
CO 5	Model digital circuits using Verilog tasks and directives.(BL-3)

CO-PO Mapping														
CO	**COURSE CONTENT**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2		3								2	2
CO2	3	3	1		3								2	1
CO3	3	3	1		3								2	2
CO4	3	3	1		3								3	1
CO5	3	3	3		3								3	3
1: Low, 2-Medium, 3- High														

COURSE CONTENT

MODULE -1	**Introduction to digital design**	**10hrs**

INTRODUCTION TO DIGITAL DESIGN. Introduction to hardware descriptive language (HDL). Difference between computer programming languages and HDLs Examples and HDL based digital design flow based on FPGA and CPL

Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis using EDA tools

At the end of the Module 1, students will be able to:

1. What is importance of HDL (Hardware Descriptive Language) (BL-2)
2. Describe difference between concurrent and sequential programming (BL-2)
3. Explain Digital design and implementation flow (BL-2)

MODULE -2	**Introduction To Verilog**	**9hrs**

Language Constructs And Conventions: Introduction, Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators.

Gate Level Modeling: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tri-State Gates, Array of Instances of Primitives, Additional Examples, Design of Flipflops with Gate Primitives, Delays, Strengths and Contention Resolution, Net Types, Design of Basic Circuits.

At the end of the Module 2, students will be able to:

1. Explain simulation and synthesis models of Digital circuits (BL-2)
2. Describe simulation techniques(BL-2)
3. Explain How to create test bench (BL-2)
4. Model digital circuits in Gate level using Verilog (BL-3)
5. Explain Gate Primitives used in Verilog (BL-2)

MODULE-3	**Verilog Modeling -1**	10h**rs**

Data Flow Level Modeling: Introduction, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators.

Behavioral Modeling: Introduction, Operations and Assignments, Functional Bifurcation, Initial Construct, Always Construct, Examples, Assignments with Delays, Wait construct, Multiple Always Blocks, Designs at Behavioral Level, Blocking and Non-blocking Assignments, The case statement, Simulation Flow. i*f*and i*f*-else constructs, assign-deassign construct, repeat construct, for loop, the disable construct, whileloop, forever loop, parallel blocks, force-release construct, Event.(6h)

At the end of the Module 3, students will be able to:

1. Model digital circuits in data flow style (BL-3)
2. Explain High level abstraction of digital systems with behavioral modeling of systems(BL-2)
3. Apply concepts behavioral constructs like ‘always’ ,’initial’, ‘if’, ‘if-else’, ‘case’..etc to describe a digital system (BL-3)

MODULE-4	**Verilog Modeling -2**	8h**rs**

Switch Level Modeling: Introduction, Basic Transistor Switches, CMOS Switch, Bi-directional Gates, Time Delays with Switch Primitives, Instantiations with Strengths and Delays, Strength Contention with Tri-reg Nets.

Functions, Tasks, And User-Defined Primitives: Introduction, Function, Tasks, User- Defined Primitives (UDP), FSM Design (Moore and Mealy Machines).(4h)

At the end of the Module 4, students will be able to:

1.Describe low level abstraction of digital systems with switch modeling of systems (BL-2)

2. Explain Switch level primitives (BL-2)

3.Describe the importance of tasks and functions (BL-2)

4. model digital systems using User- Defined Primitives (UDP) (BL-3)

MODULE-5	**Tasks and Functions**	**11hrs**

System Tasks, Functions And Compiler Directives: Introduction, Parameters, Path Delays, Module Parameters, System Tasks and Functions, File-Based Tasks and Functions, Compiler Directives, Hierarchical Access, Verilog models for memories and buses: Static RAM memory, UART Design

At the end of the Module 5, students will be able to:

1. Explain the concept of FSM (BL-2)
2. Learn compiler directives. (BL-2)
3. Describe the usage of functions and tasks in packages(BL-2)

Total hours:	**48 hours**

Term work:

1. Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work

2.Design and implement digital circuit that Controlling LEDs with Switches using FPGA.

Content beyond syllabus:

1. Vertex FPGA structure

Self-Study:

Contents to promote self-Learning:

SNO	Topic	Reference
1	Introduction To Digital Design	http://vlsibyjim.blogspot.com/2015/03/vlsi-design-flow.html https://www.tutorialspoint.com/vlsi_design/vlsi_designdigital_system.htm https://www.youtube.com/watch?v=Abld-fSxjNM
2	Introduction To Verilog	https://freevideolectures.com/course/3696/advanced-vlsi-design/23 https://www.youtube.com/watch?v=bapXMc48Ma4&feature=youtu.be https://bt.nitk.ac.in/c/19b/cs201/index.html https://nptel.ac.in/courses/117/106/117106092/
3	Gate Level And Data Flow Level Modeling	https://www.chipverify.com/verilog/verilog-gate-level-examples https://technobyte.org/gate-level-modeling-in-Verilog/ https://www.youtube.com/watch?v=aGcLzYzxTKI https://technobyte.org/dataflow-modeling-verilog/ https://www.youtube.com/watch?v=W2XH-KtO930
4	Behavioral And Switch Level Modeling:	https://technobyte.org/behavioral-modeling-verilog/ https://www.youtube.com/watch?v=QzhFeDVehpY https://www.chipverify.com/verilog/verilog-switch-level-modeling https://www.youtube.com/watch?v=vwAhcO0q3l4
5	Functions, Tasks Compiler Directives	http://www.asicguru.com/verilog/tutorial/system-tasks-and-functions/68/ http://www.verilog.renerta.com/source/vrg00008.htm https://www.youtube.com/watch?v=a3qvwHeNEQw

	6	Memory, Implementation Of Digital Circuits	https://alchitry.com/blogs/tutorials/how-does-an-fpga-work https://www.realdigital.org/doc/e3f19ac552a3f11020a8db62c525b2c4	

Text Book(s):

1. 1. T.R. Padmanabhan and B. Bala Tripura Sundari, "Design through Verilog HDL'', WSE, IEEE Press 2008.
2. 2. J. Bhaskar, "A Verilog Primer'', BSP, 2nd edition 2003.
3. Samir Palnitkar, "Verilog HDL", Pearson Education,2nd Edition,2003.

Reference Book(s):

1. Thomas and Moorby, "The Verilog Hardware Description Language", kluwer academic publishers, 5th edition, 2002.
2. Stephen Brown and Zvonko Vranesic, "Fundamentals of Logic Design with Verilog", TMH publications, 2007.
3. Charles.H.Roth,Jr., Lizy Kurian John "Digital System Design using VHDL" , Thomson, 2nd Edition, 2008

Online Resources:

1. www.xilinx.com, Xilinx project navigator evaluation tools version.
2. www.altera.com, Altera Quartus evaluation software tool

Web References:

1. https://nptel.ac.in/courses/106/105/106105165/ (Hardware modeling using Verilog, IIT Kharaghpur)
2. https://nptel.ac.in/courses/106/105/106105083/ (Electronic Design Automation, IIT Kharaghpur)
3. https://nptel.ac.in/courses/117/106/117106092/ (VLSI Circuits , IIT Madras)

NARAYANA ENGINEERING COLLEGE::NELLORE								
20EC2012	**Digital Signal Processing**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VI	3	0	0	48	3	40	60	100

Pre-requisite: Signal and systems

Course Objectives:

- To illustrate the concepts of digital signal processing techniques.
- To analyze discrete time signals by FFT Algorithms.
- To design infinite impulse response filters for filtering undesired signals.
- To design finite impulse response filters for filtering undesired signals.
- To summarize the architectural features of programmable DSP Processor.

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

CO 1	Illustrate the concepts of digital signal processing techniques. (BL-02)
CO 2	Analyze time and frequency domains description of discrete time signals using FFT Algorithms(BL-03)
CO 3	Design of IIR filters using different methods(BL-04)
CO 4	Design of FIR filters using different methods (BL-04)
CO 5	Summarize the architectural features of programmable DSP Processor. (BL-02)

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	1									2
CO2	3	3	3	3	2									3
CO3	3	3	3	3										
CO4	3	3	3	3	2									3
CO5	3	3	2	2	2								2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	**INTRODUCTION TO DSP AND DFT**	**11 Hrs**

Review of DSP & Z-Transforms, Properties of DFT, DFT as a linear transformation, DFT relationship with other transforms, multiplication of two DFTs- the circular convolution, Linear filtering methods based on DFT-overlap-save and overlap-add methods. **(7 Hr's)**

At the end of the Module 1, students will be able to:

1. Classify Discrete-time signals and systems. **(BL-02)**
2. Understand the representation of discrete time signals. **(BL-02)**
3. Find the DFT for the given sequence. **(BL-01)**
4. Compare ovelap-save and overlap-add methods. (**BL-02)**

MODULE -2	FAST FOURIER TRANSFORM	08 Hrs
Efficient computation of DFT algorithms - Radix 2-Decimation-in-Time & Decimation-in-Frequency algorithms, Inverse FFT, Illustration with an example **(8 Hr's)**		
At the end of the Module 2, students will be able to: 1. Understand FFT algorithms. **(BL-02)** 2. Find the DFT of a sequence using DIT-FFT. **(BL-01)** 3. Find the DFT of a sequence using DIF-FFT. **(BL-01)** 4. Compare the similarities and dissimilarities between DIT & DIF FFT algorithms. **(BL-02)**		
MODULE-3	**DESIGN OF IIR FILTERS**	**11 Hrs**
DESIGN OF IIR FILTERS: Design of IIR filters from analog filters (Butterworth and Chebyshev) IIR filter design by approximation of derivatives, by Impulse invariance, and by bilinear transformation methods, Frequency transformation in digital domains**,** Illustration with an example. **REALIZATION OF IIR FILTERS:** Structures for IIR systems - Direct form, Cascade form, Parallel form and Transposed structures. **(3 Hr's)**		
At the end of the Module 4, students will be able to: 1. Construct IIR filters using different structures. **(BL-03)** 2. Design IIR filters using Butterworth and Chebyshev filters. **(BL-04)** 3. Design IIR filters using Impulse invariance and bilinear transformation methods. **(BL-04)** 1. Translate IIR filters in digital domain. **(BL-02)**		
MODULE-4	**DESIGN OF FIR FILTERS**	**10 Hrs**
DESIGN OF FIR FILTERS: Introduction to FIR filters, Linear phase FIR filters, design of FIR filters using Rectangular, Hanning, Hamming, Bartlet and Blackman windows, Illustrative problems. **REALIZATION OF FIR FILTERS:** Structures for FIR systems- Direct form and Cascade form, Comparison of FIR and IIR filters.		
At the end of the Module 3, students will be able to: 2. Construct FIR filters using different structures. **(BL-03)** 3. Design FIR filters using windowing techniques. **(BL-04)** 4. Design linear phase FIR filters using various techniques. **(BL-04)**		
MODULE-5	**ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES**	**08 Hrs**
Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit.		
At the end of the Module 6, students will be able to: 1. List the architectural features of Programmable DSPs. **(BL-01)** 2. Explain the addressing modes of PDSPs. **(BL-02)** 3. Summarize the speed issues of programmable DSPs. **(BL-02)**		
	Total hours:	**48 hours**

Content beyond syllabus:

1. Addressing modes of TMS320C54XX Processors.
2. Pipeline Operation of TMS320C54XX Processors.

Self-Study:

Contents to promote self-Learning:

SNO	Topic	Reference
1	Introduction to Digital signal Processing	https://www.tutorialspoint.com/digital_signal_processing/index.htm

2	Fast Fourier Transforms	https://www.youtube.com/watch?v=EsJGuI7e_ZQ	
4	Design of IIR by Bilinear transformation method	https://www.youtube.com/watch?v=g8o51lOswfQ	
4	Design of FIR using Windowing Techniques	https://www.youtube.com/watch?v=5JpqbuRCjEE	
5	Architectures for Programmable DSP Devices	https://www.youtube.com/watch?v=tkGRGQZhczs	

Text Book(s):

1. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and applications," Pearson Education/PHI, 4 th ed., 2007.
2. Avtar Singh and S. Srinivasan, "Digital Signal Processing," Thomson Publications, 2004.
3. S.Salivahanan, A.Vallavaraj, C.Gnanapriya, "Digital signal processing", Tata McGraw Hill, 2 nd edition, 2011

Reference Book(s):

1. Sanjit K Mitra, "Digital signal processing, A computer base approach," Tata McGraw Hill, 3 rd edition, 2009
2. B. P. Lathi, "Principles of Signal Processing and Linear Systems," Oxford Univ. Press, 2011.
3. A. V. Oppenheim and R.W. Schaffer, & J R Buck, "Discrete Time Signal Processing," 2nd, Pearson Education, 2012.

Online Resources:

1. https://nptel.ac.in/courses/117/102/117102060/
2. https://www.youtube.com/watch?v=3OFNS8lxa-0
4. https://www.youtube.com/watch?v=4Q-R1E5B40Q
5. https://www.youtube.com/watch?v=vlFdVYAXIxg
6. https://www.youtube.com/watch?v=G-Jzz9fm6qo

Web Resources:

1. https://engineering.purdue.edu/~ee538/DSP_Text_3rdEdition.pdf
2. https://drive.google.com/file/d/1sKEazTJieOS_eVwC6Yh5rDLCWNPXFXpa/view
3.https://books.google.co.in/books?id=5zO6An_gAgC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2507	DIGITAL SIGNAL PROCESSING LAB							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VI	0	0	3	42	1.5	40	60	100

Pre-requisite: Knowledge on Signals and Systems and Matlab.

Course Objectives:

1. To analyze various continuous and discrete time signals using matlab functions.
2. To demonstrate the use of DFT to efficiently process discrete time signals in the frequency domain.
3. To design aspects of FIR and IIR filters for given specifications.

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

CO 1	Analyze discrete time signals & systems using MATLAB
CO 2	Design & implement IIR & FIR filters for different specifications
CO 3	Design DSP based real time processing systems to meet desired needs of the society

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3							2	2		2	2	3
CO2	2	2	2		2				2	2		2	2	2
CO3	2	3							2	2		2	2	3

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
PART-A: Software Experiments using MATLAB software (Minimum of 5 experiments are to be conducted)	
Task-1: GENERATION OF DISCRETE TIME SIGNALS	
Objective: To generate various continuous and discrete time signals using MATLAB software.	CO 1
Task-2: ENERGY AND POWER OF A SIGNAL	
Objective: To find the energy and power of a given discrete time signal using MATLAB software.	CO 1
Task-3: DFT	
Objective: To find the DFT of a given sequence using MATLAB software.	CO 2
Task-4: BUTTERWORTH IIR FILTER	
Objective: To design and implement IIR Butterworth (LP/HP) filter using MATLAB software.	CO 3
Task-5: FIR LOW PASS FILTER	
Objective: To design and implement FIR Low pass filters using any three windows in MATLAB software.	CO 3
Task-6: FIR HIGH PASS FILTER	
Objective: To design and implement FIR high pass filters using any three windows in MATLAB software.	CO 3
Task-7: FIR BAND-PASS FILTER	
Objective: To design and implement FIR band-pass filter using any three windows in MATLAB software.	CO 3
PART-B: Using DSP Processor kits (Floating point) and Code Composure Studio (CCS)	
Task-8: GENERATION OF DISCRETE TIME SIGNALS	
Objective: To generate various continuous and discrete time signals using DSP Processor	CO 1

and CC studio.	
Task-9: ENERGY AND POWER OF A SIGNAL	
Objective: To find energy and power of a given discrete time signal using CC studio.	CO 1
Task-10: DFT	
Objective: To find the DFT of a given sequence using CC studio.	CO 2
Task-11: FIR FILTER	
Objective: To design and implement FIR filters using CC Studio.	CO 3
Task-12: IIR FILTER	
Objective: To design and implement IIR filters using CC Studio.	CO 3

Additional Experiments:	
Task-13: CIRCULAR CONVOLUTION	
Objective: To find circular convolution of given two secrete time signals using MATLAB software.	CO 1
TASK-14: N-POINT DIF-FFT ALGORITHM	
Objective: To find the DFT of a given sequence using DIF FFT algorithm in MATLAB software.	CO 2
Virtual Labs: **1.** Study of Discrete Fourier Transform (DFT) and its inverse http://vlabs.iitkgp.ernet.in/dsp/exp6/index.html **2.** FIR Filter Design http://vlabs.iitkgp.ernet.in/dsp/exp8/index.html (High pass FIR Filter) http://vlabs.iitkgp.ernet.in/dsp/exp9/index.html (Band pass and Bandstop FIR filter) 3. IIR Filter http://vlabs.iitkgp.ernet.in/dsp/exp10/index.html	

Self-Study:

Contents to promote self-Learning:

SNO	Topic	Reference
1	Generation of random sequence	https://www.youtube.com/watch?v=xs2de3YBgZM
2	Energy and power of a signal	https://www.youtube.com/watch?v=Zo7CuL736GU
5	DTFT	https://www.youtube.com/watch?v=QLCXSxgxRPY
6.	N-Point FFT Algorithm	https://www.youtube.com/watch?v=nqaFs-msgUQ (DIT-FFT) https://www.youtube.com/watch?v=6yNcDybxsxo (DIF-FFT)
7.	FIR Filter Design	https://www.youtube.com/watch?v=mXVlFJOMylM (Windowing Techniques)
8.	IIR Filter Design	https://www.youtube.com/watch?v=OCHfpmACqMM (Impulse Invariance method) https://www.youtube.com/watch?v=O0DbpZqhPSg (Frequency Sampling method) https://www.youtube.com/watch?v=zQQF5orJbdg (Chebyshev Filter)

Text Book(s):

1. John G. Proakis, Dimitris G. Manolakis, "Digital signal processing, principles, Algorithms and applications," Pearson Education/PHI, 4 th ed., 2007.
2. Sanjit K Mitra, "Digital signal processing, A computer base approach," Tata McGraw Hill, 3 rd edition, 2009
3. S.Salivahanan, A.Vallavaraj, C.Gnanapriya, "Digital signal processing", Tata McGraw Hill, 2 nd edition, 2011

Reference Book(s):

1. A.V.Oppenheim and R.W. Schaffer, & J R Buck, "Discrete Time Signal Processing," 2 nd ed., Pearson Education, 2012.
2. B. P. Lathi, "Principles of Signal Processing and Linear Systems," Oxford Univ. Press, 2011.
3. Li Tan, Jean Jiang, "Digital Signal Processing, Fundamentals and Applications," Academic Press, Second Edition, 2013
4. P. Ramesh Babu, "Digital Signal Processing", 4th edition, 2006, SCITECH publication, India.

Web References:

1. https://ewh.ieee.org/r1/ct/sps/PDF/MATLAB/chapter6.pdf
2. http://aaronscher.com/Course_materials/Communication_Systems/documents/Energy_signals_matlab_tutorial.pdf
3. https://gist.github.com/yassersouri/4154139
4. http://matlab.izmiran.ru/help/techdoc/ref/fft.html
5. https://in.mathworks.com/help/signal/ref/fir1.html
6. https://in.mathworks.com/help/signal/ug/iir-filter-design.html

-NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2508	**Integrated Circuits Laboratory**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VI	0	0	3	36	1.5	40	60	100

Pre-requisite: Basic knowledge of Electronic Devices and circuits, Knowledge on dual power supply connections.

Course Objectives:

1.To understand the characteristics of operational amplifier
2. To Apply Operational Amplifiers in linear and non-linear applications.
3. To Design different types of active filters.
4.To Design and construct waveform generation circuits
5. To understand the designing industrial applications using 555 timer.

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

CO 1	Illustrate the working of Op amp ICs & Application specific analog ICs.
CO 2	Analyze operational amplifier based circuits for linear and non-linear applications.
CO 3	Design Operational amplifiers for linear and nonlinear application, Multivibrator circuits using 555 & application specific ICs.
CO 4	Simulate all linear and nonlinear application based Op amp Circuits and circuits based on application specific ICs.

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2							3	3		2	3	
CO2	2	2	2						3	3		2	3	
CO3	2	2	2						3	3		2	3	2
CO4	2	2	2						3	3		2	3	2

1: Low, 2-Medium, 3- High

Note: List of Experiments (At least twelve experiments are to be done):

COURSE CONTENT	CO
Task-1: Inverting, Non-Inverting & Unity Gain Amplifiers Using IC 741 Op-Amp	
Objective: To determine voltage gain and frequency response of inverting, non-inverting & unity Gain amplifiers using IC 741 Op-Amp.	CO 1
Task-2: Measurement of Op-Amp Parameters	
Objective: To measure offset voltages, bias currents, CMRR, Slew Rate using IC-741 Op-Amp.	CO 1
Task-3: Integrator & Differentiator Using IC 741 Op-Amps.	

Objective: To design, construct and verify the response of a) Integrator using Op-amp IC741 for sine and square wave inputs at 1 KHz frequency. b) Differentiator using Op-amp IC741 for sine and square wave inputs at 1 KHz frequency.	CO 2
Task-4: Op-Amp Applications-Zero Crossing detector, Window Detector & Schmitt trigger.	CO2
Objective: To study Zero Crossing detector, Window detector & Schmitt trigger using Op-Amp.	
Task-5: Op-Amp Applications-Signal Converters.	
Objective: To Construct suitable circuits for voltage to current converter and current to voltage converters using Op-Amp.	CO 2
Task-6: Instrumentation Amplifier Using IC 741 Op-Amps.	
Objective: To design an instrumentation amplifier and determine its voltage gain using IC-741 Op-Amp.	CO 3
Task-7: Function Generator Using IC 741 Op-Amps.	
Objective: To generate triangular and square wave forms and to determine the time period of the wave forms.	CO 3
Task-8:RC PHASE SHIFT OSCILLATOR AND WEIN BRIDGE OSCILLATOR	
Objective: To study the Operation of Wein – Bridge Oscillator and RC phase shift oscillator using IC 741 Op-Amp and to determine the frequency of Oscillations.	CO 3
Task-9: DESIGN OF ACTIVE FILTERS (LPF, HPF)	
Objective: To design, construct and plot the frequency response of a) First order low pass filter with cut-off frequency of 5 KHz b) First order high pass filter with a cut-off frequency of 1 KHz.	CO3
Task-10: Astable Multivibrator Using IC 555 Timers.	CO4
Objective: To obtain a symmetric square wave output wave forms by maintaining certain duty cycle by using 555 timers.	
Task-11: Monostable Multivibrator Using IC 555 Timers.	
Objective: To design a Monostable Multivibrator using 555 timer to get 10msec pulse output.	
Task-12: Data converters using Op-amp	
Objective: To obtain analog output voltages for the digital input data using 3-bit binary weighted resistor type DAC using Op-Amp.	CO5

Additional Experiments:	
Task-13: Low Drop Out Regulator Using IC 741 Op-Amps.	
Objective: Design and test a low Dropout regulator using op-amps for a given voltage regulation characteristic Using IC 741 Op-Amp.	CO5

Task-14: DC-DC Converter Using IC 741 Op-Amps.

Objective: Design of a switched mode power supply that can provide a regulated output voltage for a given input range using IC 741 Op-Amp.

CO 5

Virtual Labs:

1. Study of basic properties of operational amplifier: inverting and non-inverting amplifiers.
2. Study of differentiator and integrator using operational amplifier.
3. Design and simulate triangular/square waveform generator using IC 741.
4. Design and simulate Frequency response of 1st order HPF and LPF filter.

Self-Study:

Contents to promote self-Learning:

SNO	Topic	CO	Reference
1	Amplifiers & Parameters	CO1	**https://www.youtube.com/watch?v=ImTzh3kgnvA** **https://www.youtube.com/watch?v=jonWWaBdMNU** **https://www.youtube.com/watch?v=C5GcP5P25Jo** **https://www.youtube.com/watch?v=mgoCeOCjiBI&list=PL1hqL6v9rNg4tKlAW7p4vn26yRyu8XdfJ&index=41**
2	Op-Amp Applications	CO2	**https://www.youtube.com/watch?v=mgoCeOCjiBI&list=PL1hqL6v9rNg4tKlAW7p4vn26yRyu8XdfJ&index=41** **https://www.youtube.com/watch?v=cXmmlwVaA0k** **(Schimitt trigger using IC 741)**
3	IC 555 Timers,IC 565 PLL and IC 566 VCO	CO3	**https://www.youtube.com/watch?v=75hYqRtLJTQ** **(Astable using 555)** **https://www.youtube.com/watch?v=j_cJ7DV_T_M** **(IC565 PLL)** **https://www.youtube.com/watch?v=S_v70oFKmnw** **(IC566 VCO).**
4	Active Filters & D-A Converters	CO4	**https://www.youtube.com/watch?v=mgoCeOCjiBI&list=PL1hqL6v9rNg4tKlAW7p4vn26yRyu8XdfJ&index=41**

Data sheets:

1. https://www.ti.com/lit/ds/symlink/ua741.pdf.
2. https://www.st.com/resource/en/datasheet/cd00000479.pdf
3. http://eeshop.unl.edu/pdf/lm565.pdf

Reference Book(s):

1. https://datasheetspdf.com/pdf-file/514046/NXP/NE565/1
2. http://www.elektronikjk.com/elementy_czynne/IC/NE566.pdf

Web Resources for Virtual Lab:
1.http://vlabs.iitkgp.ernet.in/be/index.html

20EC2509	**ELECTRONIC DESIGN WORKSHOP**							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VI		0	3	48	1.5	40	60	100

Guidelines:

1. The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.
3. Mini Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
9. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2013	VLSI DESIGN							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VI	3	0	0	48	3	40	60	100

Pre-requisite: Basics of semiconductor devices, Electronics circuits, Digital logic Design, Physics.

Course Objectives:

1. To understand the fabrication process of MOS, CMOS, Bi-CMOS Transistors, the electrical properties of MOS circuits
2. To Know the design rules, layout diagrams, stick diagrams and will also acquaint with knowledge on electrical constraint while designing
3. To know the design of variouscomplex logic gates using CMOS and other forms of logic.
4. Subsystem design is used in VLSI integrated circuits for adders, multipliers, shifters, ALUs and Array Subsystems used in sequential circuit designs i.e. SRAM, DRAM.
5. To know the architectural details of FPGAs, CPLDs and procedural steps to develop semiconductor ICs like Full-Custom, Semi-Custom &programmable ICs.

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

CO 1	Analyze the MOS Device Equations & CMOS basic inverter characteristics. (BL-4).
CO 2	Apply the concepts of stick diagrams and layout design rules for CMOS Circuits. (BL-3).
CO 3	Design the digital complex logic gate design of various types using CMOS and other forms of logic. (BL-3).
CO 4	Develop various Data Path subsystems, parity generators, and array of memories to compensate trade-off area, speed and power requirements. (BL-3).
CO 5	Implement digital logic circuits using PLAs, FPGAs and CPLDs. (BL-4).

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3		2								2	1
CO 2	3	3	3										3	3
CO 3	3	3	3	3	1									3
CO 4	3	3	3	1	1								3	1
CO5	3	2	2	1	3								3	2

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE-1	Introduction to MOS Technologies	12 hours

Introduction to integrated circuit technologies, Basic of MOS transistors, enhancement mode MOS transistor, depletion mode MOS transistor, NMOS and CMOS fabrication, BICMOS.

ELECTRICAL PROPERTIES : Ids–Vds relationships, Threshold Voltage, Body effect, Channel length modulation, gm, gds, figure of merit ω0, Pass transistor, NMOS Inverter, CMOS Inverter analysis and design, Latch-up in CMOS circuits

At the end of the Module 1, students will be able to:

1. Illustrate the evolution of Integrated Circuits and MOS Technologies. (BL-2).
2. Compare Bipolar, NMOS, CMOS, BICMOS and GaAs technologies. (BL-2).
3. Explain PMOS Fabrication Process. (BL-2).
4. Interpret the fundamentals of MOS devices and its V-I characteristics.(BL- 4)
5. Compare the relative merits of the three different forms of pull-up for an inverter circuit.(BL-2).

MODULE-2	**VLSI CIRCUIT DESIGN PROCESS**	**9 hours**

VLSI Design Flow**,** MOS Layers, Stick Diagrams, Design Rules and Layout, 2μm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS, CMOS Inverters and Gates, Scaling of MOS Circuits: Scaling models, Scaling factors for device parameters, Limitations of Scaling.

At the end of the Module 3, students will be able to:

1. Develop the Layout of simple MOS circuits using Lambda based **design** rules. (BL-3).
2. Demonstrate how the NMOS, CMOS transistors layouts are built using 2μm CMOS Design rules.
3. Illustrate the scaling models and scaling factors for NMOS,PMOS and CMOS Devices.(BL-2)
4. Infer the limitations of scaling.

MODULE-3	**GATE LEVEL DESIGN**	**9 hours**

Logic gates and other complex gates, Switch logic, Other Forms of CMOS Logic: Pseudo-nMOS logic, Dynamic CMOS logic, Clocked CMOS (C^2 MOS) logic, CMOS Domino Logic, n-p CMOS logic.

At the end of the Module 4, students will be able to:

1. Demonstrate any logic function into Gate level design. (BL-2)
2. Illustrate various logic circuits with different design styles. (BL-2)
3. Explain CMOS domino logic and give its advantages and disadvantages. (BL-2)
4. Compare the other forms of CMOS Logic. (BL-2)

MODULE-4	**DATA PATH SUBSYSTEMS**	**9 hours**

Shifters, Design of an ALU Subsystem, Adders, Multipliers, Parity generators, SRAM, DRAM, ROM, Serial Access Memories, and Content Addressable Memory.

At the end of the Module 5, students will be able to:

1.Interpret the different architectures for adders.(BL-2)
2.Identify the speed and area trade off Adders, Multipliers and shifters.(BL-3)
3. Demonstrate the working principle and operation of different Memories. (BL-2).
4.Illustrate the read and write operations in static RAM with neat diagram. (BL-2)

MODULE-5	**IMPLEMENTATION STRATEGIES**	**9hours**

Full custom, Standard Cell, Gate Array based ASICs, PLA, PAL, PLD, and CPLD & FPGA Architecture. Programmable Array Logic, Design Approach.

At the end of the Module 6, students will be able to:

1. Illustrate the techniques of chip design using programmable devices. (BL-2).
2. Demonstrate the architecture and routing procedures of CPLD & FPGA. (BL-2).

Total hours:	**48 hours**

Content beyond syllabus:

Physical Design: Floor-Planning, Placement and Routing.

Self-Study: Contents to promote self-Learning:

SNO	Module	Reference
1	Introduction to MOS Technologies &FabBasic Electrical Properties of MOS & Bi-CMOS Circuits.	https://www.youtube.com/watch?v=lpXNCwsnxjM(Integrated Circuit Technology) https://www.youtube.com/watch?v=kcJi8gJ1kBo (History-Future Trends) https://www.youtube.com/watch?v=WsdVCCJsyfU (Evolution Integrated Circuits) https://www.youtube.com/watch?v=9SnR3M3CIm4&t=243s (Introduction to VLSI Design Basics) https://www.youtube.com/watch?v=WBa2Fw5-yU4 (MOS Transistor Switches and CMOS Logic) https://www.youtube.com/watch?v=p4E1to95w_w&list=PLuv3GM6-gsE3npYPJJDnEF3pdiHZT6Kj3&index=13&t=0s (Enhancement mode MOSFET Operation) https://www.youtube.com/watch?v=b6QRdt0xZwA&list=PLuv3GM6-gsE3npYPJJDnEF3pdiHZT6Kj3&index=13 (Depletion mode MOSFET Operation) https://www.youtube.com/watch?v=ptLeMiTwgJA (NMOS Fabrication Process). https://www.youtube.com/watch?v=QUExo3nSyxY (CMOS Fabrication) https://www.youtube.com/watch?v=b827fsVm7_4 (Fabrication of n-well Process) https://www.youtube.com/watch?v=2bdAYqZqudQ (Continuation of p-well) https://www.youtube.com/watch?v=Cld7ux8kQi8 (Twin Tub) https://www.youtube.com/watch?v=-4jOzGN0GTw (BiCMOS Fabrication Process) https://www.youtube.com/watch?v=y3cSgK-wmFs (SOI Process). https://www.youtube.com/watch?v=hHVbFHjccO8 (Resistors) https://www.youtube.com/watch?v=jp72NWXdKvA (Integrated resistor and Capacitor)https://www.youtube.com/watch?v=_rpuddEum2k&list=PLqilb1UO8M-XEyTzvmZZ_9t9ycpKOlG28&index=2&t=0s (Basic Electrical Properties part-1) https://www.youtube.com/watch?v=C2mm4UbPIT0&list=

			PLqilb1UO8M-XEyTzvmZZ_9t9ycpKOlG28&index=3&t=0s (Part-2) https://www.youtube.com/watch?v=L7s9Ar0XdMw&list=PLqilb1UO8M-XEyTzvmZZ_9t9ycpKOlG28&index=4&t=0s (Part-3) https://www.youtube.com/watch?v=CpK-3w8zURI (nMOS Logic Circuits-Pull-ups) https://www.youtube.com/watch?v=fqiYu6IOtmU(CMOS Inverter Analysis) https://www.youtube.com/watch?v=57U1LxJD0kc&list=PLqilb1UO8M-XEyTzvmZZ_9t9ycpKOlG28&index=5&t=0s(BICMOS) https://www.youtube.com/watch?v=uihFUbOTlzM Latchup in CMOS Logic	
	2	VLSI Circuit design Processes	https://www.youtube.com/watch?v=x68G7FUP9k4 https://www.youtube.com/watch?v=iRoazTYnJqo (Stick Diagrams) https://www.youtube.com/watch?v=Ew1ii_XYdtg&list=PLWchUMz3kCP5xYeW4EN6V-gsYt2XrfniG&index=2&t=0s -1 https://www.youtube.com/watch?v=tT5l1b3qLWc&list=PLWchUMz3kCP5xYeW4EN6V-gsYt2XrfniG&index=3&t=0s -2 https://www.youtube.com/watch?v=k4EnmTuIepE&list=PLWchUMz3kCP5xYeW4EN6V-gsYt2XrfniG&index=4&t=0s -3 https://www.youtube.com/watch?v=GpVHcXoZkA0&list=PLWchUMz3kCP5xYeW4EN6V-gsYt2XrfniG&index=5&t=0s -4 https://www.youtube.com/watch?v=jkofN9fhHK8&list=PLWchUMz3kCP5xYeW4EN6V-gsYt2XrfniG&index=6&t=0s - 5 https://www.youtube.com/watch?v=SC4nDbebpsM&list=PLWchUMz3kCP5xYeW4EN6V-gsYt2XrfniG&index=12&t=0s- (CMOS XOR Gate) https://www.youtube.com/watch?v=D_M_6xgyxjo&list=PLWchUMz3kCP5xYeW4EN6V-gsYt2XrfniG&index=9&t=0s (Design Rules and layout for cmos logic gates) https://www.youtube.com/watch?v=1aqKlr0NsiU (MOS LAYERS,STICK Diagrams, Design Rules and Layout) https://www.youtube.com/watch?v=vXb3miSeXZw&list=PLWchUMz3kCP5xYeW4EN6V-	

		gsYt2XrfniG&index=10&t=0s (Types of contact Cuts) https://www.youtube.com/playlist?list=PLqilb1UO8M-W65iA7Pr8E3_QyWHgnon1S (Basic Circuit Concepts)
3	Gate Level Design	https://www.youtube.com/watch?v=8caQpnxa3iE (CMOS NAND,NOR and Other Gates: Clocked CMOS) https://www.youtube.com/watch?v=q8adOpQx7tc (Dynamic CMOS,Pass transistor, Transmission gate)
4	Data Path Subsystems	https://www.youtube.com/playlist?list=PLqilb1UO8M-US31joQFPJ4juX1sX9KkcH (VLSI Subsystem Design) https://www.youtube.com/watch?v=36hCizOk4PA (Half & Full Adder, Carrylook ahead adder) https://www.youtube.com/watch?v=4ukbN83kY54&list=PLWchUMz3kCP5xYeW4EN6V-gsYt2XrfniG&index=26&t=0s (Design of 4 Bit ALU) https://www.youtube.com/watch?v=Lc-AWOJ1qwo&list=PLWchUMz3kCP5xYeW4EN6V-gsYt2XrfniG&index=27&t=0s (Carry select adder, carry skip adder, CLA) https://www.youtube.com/watch?v=EMcW9EggY0s&list=PLbMVogVj5nJTDr6KqQXNcxCvooSMnBuXj&index=13 (Multipliers) https://www.youtube.com/watch?v=5-PI4T25OXI&list=PLZe4P0P_9CovC7jP0URDHzI31kkTEMS70&index= (Array Multiplier) https://www.youtube.com/watch?v=5PVweRB4QvY&list=PLWchUMz3kCP5xYeW4EN6V-gsYt2XrfniG&index=24&t=0s (4 Bit Barrel Shifter) https://www.youtube.com/watch?v=HuSWjf0NToI (Parity generator) https://www.youtube.com/watch?v=dmBc-E3EpgA https://www.youtube.com/watch?v=k5VBJcUcaWU (High Density Memories) https://www.youtube.com/watch?v=wNNtz_My2ps (DRAM)
5	Semiconductor Integrated Circuit Design	https://www.youtube.com/watch?v=JAN7odb8n90 (Full Custom, semi Custom etc) https://www.youtube.com/watch?v=gCAYY0fHPq4 (PLDS:PLA,PAL,CPLD,FPGA)

			https://www.youtube.com/watch?v=khZkhE6wJis (Vlsi Design Methodology) https://www.youtube.com/watch?v=CLUoWkJUnN0&list=PLB19593440B2BB5DC&index=36&t=0s (Introduction to FPGA) https://www.youtube.com/watch?v=tJGtT9ky3H0 CPLD Architecture https://www.youtube.com/watch?v=kg5FAlAQdmU CPLD &FPGA https://www.youtube.com/watch?v=r8bziBVnPdU https://www.youtube.com/watch?v=0nMHJ0VoYhY FPGA Architecture https://www.youtube.com/watch?v=n0xljhsZDUg&list=PLB19593	

Text Books:

1. Kamran Eshraghian, Douglas A. Pucknell and Sholeh Eshraghian, *Essentials of VLSI Circuits and Systems*, PHI, 2005.
2. P.P. Sahu, VLSI Design, TMH, 1st edition 2013.
3. K.Lal Kishore and V.S.V. Prabhakar, "VLSI DESIGN", IK Publishers,1st edition 2009

Reference Books:

1.John P Uyemura, Introduction to VLSI Circuits and Systems, Wiley India, 2006
2. Jhon F.Wakerly, "Digital Design Principles & Practices", Pearson Education Asia, 3rd Edition, 2005.
3. John M. Rabaey, Digital Integrated Circuits: A Design Perspective, PHI, 2nd Edition, 1997.
4. Wayne Wolf, "Modern VLSI Design", Pearson Education, 3rd Edition, 2008.
5.Sabastian smith, "Application Specific Integrated Circuits", Addison Wesley Publishing Company Incorporated, 2008
6.Principles of CMOS VLSI Design- Weste and Eshraghian, Pearson Education,1999

Online Resources:

1. https://www.y2mate.com/youtube/faiEVOOCe-s
2. https://www.btechguru.com/courses--nptel--electronics-and-communication-engineering--advanced-vlsi-design-video-lecture--ECE--EC117101004V.html
3. https://www.youtube.com/watch?v=khZkhE6wJis
4. https://www.youtube.com/watch?v=m86zSu8vbZE
5. https://www.youtube.com/watch?v=W7LhLL75DYo
6. https://www.youtube.com/watch?v=Ew1ii_XYdtg&list=PLWchUMz3kCP5xYeW4EN6V-gsYt2XrfniG

Web References:

1.https://nptel.ac.in/courses/117/101/117101058/
2.http://www.powershow.com/view/3d1876-Y2ViN/Design_Rules_EE213_VLSI_Design_Stick_Diagrams_VLSI_design_powerpoint_ppt_presentation
3.http://www.faadooengineers.com/threads/2274-VLSI-Tutorial-Full-Detailed-EbookPresentation-amp-Lecture-Notes

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2014	MICROWAVE & OPTICAL COMMUNICATIONS							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VII	3	0	0	48	3	40	60	100

Pre-requisite: EMTL, Engineering physics

Course Objectives:

1. To apply Electromagnetic Theory for calculating waveguides and transmission lines
2. To Summarize microwave system and components in terms of network theory(scattering Matrix
3. To illustrate microwave components such as ferrite devices
4. To outline the basic elements of optical fiber transmission link, fiber modes configurations and structures
5. To Summarize the various optical source materials, LED structures, quantum efficiency, Laser diodes and applications

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

CO 1	Interpret the importance of waveguides
CO 2	Illustrate the working of passive devices
CO 3	Differentiate Linear bean tubes and crossed field tubes in terms of operation and performance
CO 4	Analyze the signal propagation in optical fibers
CO 5	Select appropriate optical sources and detectors for specific applications

CO-PO Mapping

CO	PO												PSO	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1										1	
CO2	3	3	1	1									1	
CO3	3	3	1	1									3	
CO4	3	3	1	1									1	
CO5	3	3	1	1		1							3	

1: Low, 2-Medium, 3- High

COURSE CONTENT

MODULE – 1	WAVEGUIDES	9 Hrs

WAVEGUIDES AND COMPONENTS: Introduction, microwave spectrum and bands, applications of microwaves. Rectangular waveguides, circular waveguides, microwave cavities.

At the end of the Module 1, students will be able to:

1. Explain impedance matching network for any transmission line or system. **(BL-02)**

2. Understand various parameters of waveguide and use of component as per applications. **(BL-02)**
3. Find impedance by using smith chart. **(BL-01)**
4. Explain various waveguides. **(BL-02)**
5. Summarize various waveguide components. **(BL-02)**

MODULE-2	MICROWAVE PASSIVE COMPONENTS	9 Hrs

Microwave passive devices : Microwave hybrid circuits, directional couplers, circulators and isolators. Coaxial connectors, adapters, Phase shifters, Attenuators, Waveguide Tees**.**
Microwave Semiconductor Devices: Gunn Oscillator – Principle of operation, Characteristics, Two valley model, IMPATT, TRAPATT diodes.

At the end of the Module 3, students will be able to:

1. Explain different parameters of two port devices. **(BL-02)**
2. Understand the operation of various passive devices and find their application in various fields. **(BL-02)**
3. Find the S matrix of multiport networks. **(BL-01)**
4. Understand Symmetrical Z and Y parameters. **(BL-02)**
5. Summarize various Microwave passive devices. **(BL-01)**

MODULE-3	MICROWAVE TUBES AND MEASUREMENTS	10 Hrs

Microwave Tubes: (i) Linear Beam Tubes – Two cavity Klystron amplifier -velocity modulation, bunching process, output power, Reflex Klystron oscillator, power output and efficiency, Travelling Wave Tube (TWT).
(ii) **Crossed Field Tubes** – Magnetron oscillator, pi-mode operation, power output and efficiency, Hartree Condition, Mode jumping in Magnetron
Microwave measurements: microwave bench, errors and precautions, power, attenuation, frequency, standing wave, impedance measurements.

At the end of the Module 3, students will be able to:

1.Understand principle of operation of Microwave Tubes (BL-1)
2.Understand principle of operation of Microwave Semiconductor devices (BL-1)
3.Derive the expressions power output and efficiency of all microwave devices (BL3)
4.Differentiate Linear bean tubes and crossed field tubes in terms of operation and performance (BL5)

MODULE-4	INTRODUCTION TO OPTICAL FIBERS	10 Hrs

Evolution of fiber optic system-Elements of an Optical Fiber Transmission link-Ray Optics-Optical Fiber Modes and Configurations**.** Single Mode Fibers-Graded Index fibers Structure**.**
Signal Degradation Optical Fibers: Attenuation–Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Waveguides

At the end of the Module 4, students will be able to:

1. Understand the fundamental principles of optics and light wave. **(BL-02)**
2. Explain the transmission characteristics of optical fiber. **(BL-02)**
3. Explain various losses in optical fibers. **(BL-02)**
4. Illustrate the signal distortion in optical waveguides. **(BL-02)**
5. Explain different fibers structures. **(BL-02)**

MODULE-5	FIBER OPTICAL COMPONENTS AND APPLICATIONS	10 Hrs

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, PIN and APD diodes.
Applications of optical communication: Telephony, Telemetry, video distribution, military applications.

At the end of the Module 5, students will be able to:

1. Explain optical fiber communication links using appropriate optical fibers light sources. **(BL-02)**
2. Outline the various LED structures. **(BL-02)**
3. Explain the terms quantum efficiency, LED power, Modulation of a LED. **(BL-02)**
4. Explain the operation of LASER PIN,APD diodes. **(BL-02)**
5. List various applications of Fiber optical receivers. **(BL-01)**

Total hours:	**48hours**

Term work: Able to analyze and find applications and limitations of microwave tubes and Amplifiers, Explore concept of designing and operating principles of modern optical systems

Content beyond syllabus:

1. Flexible branching of an optical fiber.
2. Expanding applications of bending-loss-resistant fiber

Self-Study:

Contents to promote self-Learning:

SNO	**Topic**	**Reference**
1	Microwave transmission lines	https://www.tutorialspoint.com/microwave_engineering/microwave_engineering_transmission_lines.htm
2	Microwave network theory and passive devices	https://www.youtube.com/watch?v=tKZ-lAzYLys, https://www.youtube.com/watch?v=rKLy9_mNryw
3	Microwave Tubes and Diodes	http://www.clivepoole.com/wp-content/uploads/2016/07/Lecture-11-Microwave-Semiconductor-Materials-and-Diodes.pdf
4	Fiber optic System	https://www.tutorialspoint.com/principles_of_communication/principles_of_optical_fiber_communications.ht
5	Fiber optical sources &receivers	https://www.youtube.com/watch?v=nmcL8SVUrNA https://www.electronics-notes.com/articles/connectivity/fibre-optics/optical-receiver.php

Text Book(s):

1. Microwave devices and Circuits-Samuel Y. Liao, Pearson, 3rd Edition, 2003.
2. Microwave principles-Herbert J.Reich,J.G.Skalnik, P.F.Ordung and H.L.Krauss, CBS publishers and distributors, New Delhi,2004
3. GerdKeiser,"OpticalFiberCommunication"McGraw–HillInternational,Singapore,3rd ed.,2000
4. J.Senior,"OpticalCommunication,PrinciplesandPractice",PrenticeHallofIndia,1994

Reference Book(s):

1. Foundations for microwave engineering-R.E.Collin, IEEE press, John Wiley, 2ndedition, 2002
2. Microwave circuits and passive devices-M.L.Sisodia and G.S.Raghuvanshi,Wiley Eastern Ltd.,New age International publishers Ltd., 1995.
3. Microwave engineering passive circuits-Peter A.Rizzi, PHI, 1999.
4. Electronic and Radio Engineering-F.E.Terman, McGraw-Hill, 4th Edition, 1995
5. Microwave Engineering – A. Das, TMH, 2nd ed., 2009
6. MaxMing-KangLiu,"Principles and Applications of Optical Communications" ,TMH,2010.2 .S.C.Gupta,"Textbook on optical fiber communication and its applications",PHI,2005.
7. Satish Kumar,"Fundamentals of Optical Fiber communications",PHI,2009

Online Resources:

1. https://www.youtube.com/watch?v=pavBq7HIoIE
2. https://www.youtube.com/watch?v=q6_q2IBm93o
3. https://www.youtube.com/watch?v=WR4559RqRzU
4. https://www.digimat.in/nptel/courses/video/108104113/L11.html
5. https://www.digimat.in/nptel/courses/video/108104113/L31.html
6. https://www.youtube.com/watch?v=5R0el7gznys
7. https://www.youtube.com/watch?v=zVlWCz9vTL4
8. https://www.youtube.com/watch?v=kMYGs_9wY-U
9. www.nptelvideos.in/2012/12/advanced-optical-communication.html

Web References:

1. https://www.tutorialspoint.com/microwave_engineering/microwave_engineering_useful_resources.htm
2. https://www.electronics-notes.com/articles/electronic_components/diode/schottky-barrier-diode.php
3. https://d13mk4zmvuctmz.cloudfront.net/assets/main/study-material/notes/electronics-communication_engineering_optical-fiber-communication_analog-and-digital-links_notes.pdf
4. https://www.microwaves101.com/encyclopedias/books-on-microwave-engineering
5. https://en.wikipedia.org/wiki/Microwave_engineering
6. http://www.microwaveeng.com
7. http://www.meslmicrowave.com/microwave-integrated-circuits/overview/

NARAYANA ENGINEERING COLLEGE:NELLORE								
20EC2509	VLSI DESIGN LAB							R20
Semester	Hours / Week			Total hrs	Credit	Max Marks		
	L	T	P		C	CIE	SEE	TOTAL
VI	0	0	3	36	1.5	40	60	100

Pre-requisite: A course on Microwave and optical communications.

Course Objectives:

1. To understand how to measure different performance parameters of the circuits.
2. To Create some innovative ideas for the students to design various circuits to satisfy the performance parameters of the design.
3. To design the layouts for logic circuits

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

CO 1	Develop Verilog HDL source code for the given problem/experiment, and simulate the given circuit with suitable simulator and verify the results.
CO 2	Analyze the obtained results of the given experiment/problem.
CO 3	Implement the experiments using FPGA/CPLD hardware tools.

CO-PO Mapping

CO	PO												PSO	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2						2	3		2	2	3
CO2	3	2	2						2	3		2	2	3
CO3	3	3	2						2	3		2	2	3

1: Low, 2-Medium, 3- High

COURSE CONTENT	CO
Task-1: Realization of Logic gates	
Objective: Develop VERILOG model for all basic gates and simulate to verify the functionality and synthesize to verify the RTL schematic.	CO 1
Task-2: Design and Implementation of 4-Bit ripple carry and carry look ahead adder using Behavioral, Dataflow and Structural modeling.	
Objective: Develop the VERILOG model for 4-bit ripple carry adder and simulate to verify the functionality and synthesize to verify the RTL schematic.	CO 1
Task-3: Design and Implementation of 16 to 1 mux through 4 to 1 mux.	
Objective: Develop the VERILOG model for 16:1 mux. through 4:1 mux. and simulate to verify the functionality and synthesize to verify the RTL schematic.	CO 1
Task-4: Design and Implementation of 8 to 3 encoder.	

Objective: Develop the VERILOG model for 8 to 3 encoder to and simulate to verify the functionality and synthesize to verify the RTL schematic.	CO 1
Task-5: Design and Implementation of 8-bit parity generator and checker.	
Objective: Develop the VERILOG model for 8-bit parity generator and simulate to verify the functionality and synthesize to verify the RTL schematic.	CO 1
Task-6: Design and Implementation of D-Flip-Flop.	
Objective: Develop the VERILOG model for D-flip flop and simulate to verify the functionality and synthesize to verify the RTL schematic.	CO 1
Task-7: Design and Implementation of 8 bit synchronous up-down counter.	
Objective: Develop the VERILOG model for 8-bit synchronous up-down counter and simulate to verify the functionality and synthesize to verify the RTL schematic.	CO 1
Task-8: **Design and simulate a CMOS Inverter**	
Objective: To generate layout for inverter using Tanner/Micro wind tool or equivalent industry standard software and simulate to verify the functionality.	CO 2
Task-9: Design and simulate CMOS NAND and NOR Gate.	
Objective: (1) To generate layout for NAND gate using Tanner/Micro Wind tool or equivalent industry standard software and simulate to verify the functionality. (2) To generate layout for NOR Gate using Tanner/Micro Wind Tool or Equivalent Industry Standard Software and simulate to verify the functionality.	CO 2
Task10: Design and simulate CMOS Full Adder.	
Objective: To generate layout for FULL ADDER using Tanner/Micro wind tool or equivalent industry standard software and simulate to verify the functionality.	CO 2
Task-11: Design and simulate CMOS Full Subtractor.	
Objective: To generate layout for Full Subtractor using Tanner/Micro Wind Tool or equivalent Industry Standard Software and simulate to verify the functionality.	CO3
Task-12: Design and simulate D-Latch using CMOS.	
Objective: To generate layout for a D-Latch using Tanner/Micro wind tool or equivalent industry standard software and simulate to verify the functionality.	CO 3

Additional Experiments:	
Task-13: Design and Implementation of 4-bit sequence detector through Mealy state machines.	
Objective: Develop VHDL model for 4-bit sequence detector using Mealy state machines to simulate to verify the functionality and synthesize to verify the RTL schematic.	CO 3
Task-14: Design and simulate 2 to 4 Decoder using CMOS.	
Objective: Develop VHDL model for 2 to 4 decoder using Tanner/Micro wind tool or equivalent industry standard software and simulate to verify the functionality.	CO 2

Self-Study:

Contents to promote self-Learning:

SNO	Topic	Reference
1	MOSFETS	https://www.youtube.com/watch?v=H7Gdz4QTvUU
2	CMOS Inverter	https://www.youtube.com/watch?v=U3GfEHDrOaQ
4	Logic Gates	https://www.youtube.com/watch?v=cXeJGuAvh64 https://www.youtube.com/watch?v=EHUJda2ttU8
5	4X1 Multiplexer	https://www.youtube.com/watch?v=WmwtSMYSZfI
6	Latches	http://vlab.amrita.edu/?sub=3&brch=165&sim=907&cnt=2643
7	Two Input NAND & NOR Gates	https://www.youtube.com/watch?v=KfFALBexgfY https://www.youtube.com/watch?v=h4P0rIzyTtY https://www.youtube.com/watch?v=W-kMzdOpf9M
8	CMOS Inverters	https://www.youtube.com/watch?v=5FF5uRpWbjo https://www.youtube.com/watch?v=YLh9BpFpvDU https://www.youtube.com/watch?v=FqzzpobtL8c

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1. KamranEshraghian, Eshraghian Douglas and A. Pucknell, “Essentials of VLSI circuits and systems”, PHI, 2013 edition.
2. K.Lal Kishore and V.S.V. Prabhakar, “VLSI Design”, IK Publishers
3. Razavi, Design of Analog CMOS Integrated Circuits, Tata McGraw Hill Publications, 2002.

Reference Book(s):

1. J.M. Rabaey, A. Chandrakasan and B. Nikolic, Digital Integrated Circuits- A Design Perspective, 2nd edition, PHI, 2003.
2. Weste, CMOS VLSI Design: A Circuits And Systems Perspective ,3rd edition, Pearson Education India, 2007.

Web References:

1. https://nptel.ac.in/courses/117/101/117101058/
2. http://www.powershow.com/view/3d1876-Y2ViN/Design_Rules_EE213_VLSI_Design_Stick_Diagrams_VLSI_design_powerpoint_ppt_presentation
3. http://www.faadooengineers.com/threads/2274-VLSI-Tutorial-Full-Detailed-EbookPresentation-amp-Lecture-Notes

NARAYANA ENGINEERING COLLEGE: NELLORE								
20EC2511	**MICROWAVE AND OPTICAL COMMUNICATION LAB**							**R20**
Semester	**Hours / Week**			**Total hrs**	**Credit**	**Max Marks**		
	L	**T**	**P**		**C**	**CIE**	**SEE**	**TOTAL**
VII	**0**	**0**	**3**	**36**	**1.5**	**40**	**60**	**100**

Pre-requisite: A course on Microwave and optical communications.

Course Objectives:

1. To study and analyze microwave components by measuring various parameters.
2. To verify the characteristics of optical sources.
3. To measure attenuation and distortions in optical fiber link.
4. To analyze radiation pattern of horn antenna

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

CO 1	Analyze the waveguides in different modes of operation. (BL-4)
CO 2	Interpret the limitations of conventional tubes at microwave frequencies and different microwave oscillators & amplifiers. (BL-3)
CO 3	Analyse the optical fibre communications link. (BL-4)

CO-PO Mapping

CO	**PO**												**PSO**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	2						2	3		2	2	2
CO2	2	2	2						2	3		2	2	2
CO3	2	3	2						2	3		2	2	2

1: Low, 2-Medium, 3- High

COURSE CONTENT	**CO**
Task-1: Characteristics of a Reflex Klystron And Electronic Tuning	
Objective: Use microwave bench setup to Study the mode characteristics and electronic tuning range of reflex klystron.	CO 3
Task-2: V-I Characteristics of Gunn Oscillator	
Objective: Use microwave bench setup to study the V-I characteristics of GUNN diode and find the threshold voltage and current point.	CO 2
Task-3: To Determine the Attenuation of A Given Unknown Attenuator	
Objective: Use microwave bench setup to determine the attenuation of a given unknown attenuator.	CO 3
Task-4: Multi-Hole Directional Coupler	
Objective: Use microwave bench setup to study the characteristics of directional coupler and determine the different parameters.	CO 2
Task-5: VSWR Measurement	

Objective: Use microwave bench setup to find VSWR and impedance of an unknown load that is connected at the end of the bench set up. Make use of VSWR meter for the measurement of VSWR of a given load.	CO 3
Task 6: Frequency and Wavelength of Waveguide	
Objective: Use microwave bench setup to determine the frequency and wavelength of waveguide.	CO 1
Task-7: Characteristics of Magic Tee	
Objective: Use microwave bench setup to study the characteristics of magic tee and find the scattering parameters.	CO 2
Task-8: Characteristics of Fiber Optic LED	
Objective: To study the characteristics of fiber optic LED and photo detector.	CO 5
Task-9: VI Characteristics of Laser Diode	
Objective: To Measure the VI Characteristics of Laser Diode.	CO 5
Task-10: Optical Fiber Digital Link	
Objective: To set up an optical fiber digital link and to study the relationship between the transmitted and received signal.	CO 4
Task-11: Numerical Aperture of an Optical Fiber	
Objective: To study the numerical aperture of an optical fiber.	CO 4
Task-12: Optical Fiber Analog Link	
Objective: To set up an optical fiber analog link and to study the relationship between the transmitted and received signal.	CO 4

Additional Experiments:	
Task-13: Impedance Measurement	
Objective: Use microwave bench-setup to measure the unknown impedance by using smith chart.	CO 3
Task-14: Characteristics of E-Plane T, H-Plane T	
Objective: Use microwave bench setup to find the S - matrix Characterization of E-Plane T, H-Plane T	CO 2

Tools / Equipment Required:

1.Regulated Klystron Power Supply 6 nos.
2. VSWR Meter 6 nos.
3. Milli/Micro Ammeters 10 nos.
4. Multi meters 10 nos.
5. CROs 8 nos.
6. GUNN Power Supply, Pin Moderator4 nos.
7. Relevant Microwave components –
8. Fiber Optic Analog Trainer based LED3 nos.
9. Fiber Optic Analog Trainer based laser2nos.
10. Fiber Optic Digital Trainer 1 no.
11. Fiber cables - (Plastic, Glass)

Virtual Labs:

https://www.iitk.ac.in/mimt_lab/vlab/index.php?pg=/theory&usr=&enc=
http://vlab.amrita.edu/index.php?sub=59&brch=163
http://vlab.amrita.edu/index.php?sub=59&brch=163

Self-Study:

Contents to promote self-Learning:

S.NO	Topic	CO	Reference
1	Presentation on microwave virtual lab	CO 1	https://youtu.be/SkhPWhmfZzA
2	Reflex Klystron Characteristics	CO2	https://youtu.be/3HczHYTiJ44
3	Characteristics of LED	CO 5	https://youtu.be/TUjrTqkjwBk
4	Characteristics of Laser diode	CO 5	https://youtu.be/Njbg3cDxnoA

Text Book(s):

1. Microwave devices and Circuits-Samuel Y. Liao, Pearson, 3rd Edition, 2003.
2. Microwave principles-Herbert J.Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, CBS publishers and distributors, New Delhi,2004
3. GerdKeiser,"OpticalFiberCommunication"McGraw–HillInternational,Singapore, 3rd ed.,2000
4. J.Senior,"OpticalCommunication,PrinciplesandPractice",PrenticeHallofIndia,1994

Reference Book(s):

1. Foundations for microwave engineering-R.E. Collin, IEEE press, John Wiley, 2ndedition, 2002
2. Microwave circuits and passive devices-M.L. Sisodia and G.S. Raghuvanshi,Wiley Eastern Ltd.,New age International publishers Ltd., 1995.
3. Microwave engineering passive circuits-Peter A. Rizzi, PHI, 1999.
4. Electronic and Radio Engineering-F.E. Terman, McGraw-Hill, 4th Edition, 1995
5. M. Ming-Kang Liu, "Principles and Applications of Optical Communications" ,TMH,2010.

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1. https://www.tutorialspoint.com/microwave_engineering/index.htm
2. https://www.tutorialspoint.com/principles_of_communication/principles_of_optical_fiber_communications.htm
3. https://nptel.ac.in/courses/108103141
4. https://youtu.be/SkhPWhmfZzA
5. https://youtu.be/3HczHYTiJ44
6. https://youtu.be/TUjrTqkjwBk
7. https://youtu.be/Njbg3cDxnoA