NRI INSTITUTE OF TECHNOLOGY

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POTHAVARAPPADU (V), (VIA) NUNNA, AGIRIPALLI (M), PIN – 521 212

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE STRUCTURE FOR FIRST YEAR B.TECH PROGRAMME

I YEAR I SEMESTER- R18 REG

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	HS	Professional English – I	2	1	-	3	40	60	100	3
2	20A1100201	Engineering Mathematics – I	2	1	-	3	40	60	100	3
3	20A1100 203	Applied Physics	2	1	-	3	40	60	100	3
4	ES	Fundamentals of Electrical Engineering.	2	1	-	3	40	60	100	3
5	20A1103 301	Engineering Graphics	1	-	2	3	40	60	100	2
6	HS	English Communication Skills lab – I	-	-	4	4	40	60	100	2
7	BS	Applied Chemistry lab	-	-	2	2	40	60	100	1
8	LC	Automation tools & Professional Workshop	-	-	2	2	40	60	100	1
Total			9	4	10	23	320	480	800	18

I YEAR II SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Max Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	**HS**	**Professional English – II**	**2**	**1**	**-**	**3**	**40**	**60**	**100**	**3**
2	BS	Engineering Mathematics – II	3	1	-	4	40	60	100	4
3	BS	Applied Chemistry	2	1	-	3	40	60	100	3
4	ES	Programming and Problem solving with C	3	1	-	4	40	60	100	4
5	PC	Electronics Devices and Circuits	3	1	-	4	40	60	100	4
6	MC	Environmental Studies	2	1	-	3	40	60	100	0
7	HS	English Communication Skills lab – II	-	-	3	3	40	60	100	1.5
8	BS	Applied Physics lab	-	-	2	2	40	60	100	1
9	ES	Programming and Problem solving with C Lab	-	-	3	3	40	60	100	1.5
Total			15	6	8	29	360	540	900	22

L - LECTURE T – TUTORIAL P - PRACTICAL
CIA – Continuous Internal Assessment SEA – Semester End Assessment

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE STRUCTURE FOR SECOND YEAR B.TECH PROGRAMME

II YEAR I SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	ES	Network Analysis and Transmission lines	3	-	-	3	40	60	100	3
2	BS	Digital Electronics and Logic Design	3	-	-	3	40	60	100	3
3	PC	Signals and Systems	3	-	-	3	40	60	100	3
4	OE	Open Elective -I	3	-	-	3	40	60	100	3
5	BS	Engineering Mathematics -III	3	-	-	3	40	60	100	3
6	HS	Managerial Economics and Financial Analysis	3	-	-	3	40	60	100	3
7	PC	Electronic Devices and Circuits Lab	-	-	2	2	40	60	100	1
8	ES	Network Analysis Laboratory	-	-	2	2	40	60	100	1
9	ES	Basic Simulation Laboratory	-	-	2	2	40	60	100	1
Total			18	-	6	24	360	540	900	21

II YEAR II SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	PC	Analog Communications	3	-	-	3	40	60	100	3
2	PC	Analog & Pulse Circuits	3	-	-	3	40	60	100	3
3	ES	Electro Magnetic Field Theory	3	-	-	3	40	60	100	3
4	ES	Control Systems	3	-	-	3	40	60	100	3
5	BS	Probability Theory and Stochastic Process	3	-	-	3	40	60	100	3
6	OE	Open Elective –II	3	-	-	3	40	60	100	3
7	MC	Professional Ethics and Human Values	2	-	-	2	40	60	100	0
8	PC	Analog Communication Laboratory	-	-	2	2	40	60	100	1
9	PC	Analog and Pulse Circuits Laboratory	-	-	2	2	40	60	100	1
10	PC	Digital Electronics and Logic Design Laboratory	-	-	2	2	40	60	100	1
Total			20	-	6	26	400	600	1000	21

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE STRUCTURE FOR THIRD YEAR B.TECH PROGRAMME

III YEAR I SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	PC	Linear and digital Integrated circuits	3	1	-	4	40	60	100	4
2	PC	Digital Communications	3	1	-	4	40	60	100	4
3	PC	Antennas and Wave Propagation	3	1	-	4	40	60	100	4
4	PE	**Professional Elective I**	3	-	-	3	40	60	100	3
5	OE	**Open Elective III**	3	-	-	3	40	60	100	3
6	MC	IPR and Patents	2	-	-	2	40	60	100	0
7	PC	Linear and Digital Integrated Circuit laboratory	-	-	2	2	40	60	100	1
8	PC	Digital Communication Laboratory	-	-	2	2	40	60	100	1
9	PC	VHDL Programming Lab	-	-	2	2	40	60	100	1
Total			**17**	**3**	**6**	**26**	**360**	**540**	**900**	**21**

III YEAR II SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	PC	VLSI Design	3	1	-	4	40	60	100	4
2	PC	Digital Signal Processing	3	1	-	4	40	60	100	4
3	PC	Microprocessors and Microcontrollers	3	1	-	4	40	60	100	4
4	PE	**Professional Elective II**	3	-	-	3	40	60	100	3
5	OE	**Open Elective IV**	3	-	-	3	40	60	100	3
6	PC	Microprocessors and Microcontrollers Laboratory	-	-	2	2	40	60	100	1
7	PC	Digital Signal Processing Laboratory	-	-	2	2	40	60	100	1
8	PC	VLSI Laboratory	-	-	2	2	40	60	100	1
Total			**15**	**3**	**6**	**24**	**320**	**480**	**800**	**21**

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE STRUCTURE FOR FOURTH YEAR B.TECH PROGRAMME

IV

IV YEAR I SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	PC	Microwave Engineering	3	1	-	4	40	60	100	4
2	PC	Optical Communication	3	-	-	3	40	60	100	3
3	PC	Digital Image Processing	3	1	-	4	40	60	100	4
4	PE	**Professional Elective III**	3	-	-	3	40	60	100	3
5	PE	**Professional Elective IV**	3	-	-	3	40	60	100	3
6	MC	***Indian Constitution (MC)***	2	-	-	2	40	60	100	0
7	PC	Microwave Engineering & OC Lab	-	-	2	2	40	60	100	1
8	PR	Mini Project	-	-	8	8				4
Total			17	1	14	32	320	480	800	22

IV YEAR II SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	PE	**Professional Elective V (MOOCS)**	3	-	-	3	40	60	100	3
2	PE	**Professional Elective VI (MOOCS)**	3	-	-	3	40	60	100	3
3	PR	Main Project and Seminar	-	-	16	16	80	120	200	8
		Total	**6**	**-**	**16**	**22**	**160**	**240**	**400**	**14**

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROFESSIONAL CORE ELECTIVE – I

Sl. No	Course Code	Title of the Course	L	T	No. of Credits
1	PE I	Telecommunication Switching systems and networks	3	-	3
2	PE I	Computer Organization and Architecture	3	-	3
3	PE I	Electronic Measurements and Instrumentation	3	-	3

PROFESSIONAL CORE ELECTIVE - II

Sl. No	Course Code	Title of the Course	L	T	No. of Credits
1	PE II	Cellular & Mobile Communications	3	-	3
2	PE II	Digital System Design	3	-	3
3	PE II	Electromagnetic Interference & Electromagnetic Compatibility	3	-	3

PROFESSIONAL CORE ELECTIVE - III

Sl. No	Course Code	Title of the Course	L	T	No. of Credits
1	PE III	Satellite Communications & RADAR Engineering	3	-	3
2	PE III	Data Base Management Systems	3	-	3
3	PE III	Embedded System Design	3	-	3

PROFESSIONAL CORE ELECTIVE - IV

Sl. No	Course Code	Title of the Course	L	T	No. of Credits
1	PE IV	Data Communications	3	-	3
2	PE IV	Operating Systems	3	-	3
3	PE IV	Analog IC Design	3	-	3

PROFESSIONAL CORE ELECTIVE - V

Sl. No	Course Code	Title of the Course	L	T	No. of Credits
1	PE V	Wireless Communications and Networks	3	-	3
2	PE V	Soft Computing Techniques	3	-	3
3	PE V	Digital IC Design	3	-	3

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROFESSIONAL CORE ELECTIVE - VI

Sl. No	Course Code	Title of the Course	L	T	No. of Credits
1	PE VI	Computer Networks	3	-	3
2	PE VI	Internet of Things	3	-	3
3	PE VI	Artificial Intelligence	3	-	3

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

OPEN ELECTIVES OFFERED BY ECE DEPARTMENT

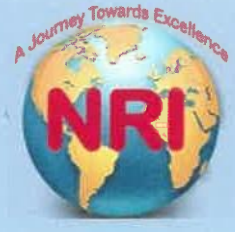
Sl. No	Course Code	Title of the Course	No. of Credits
1	OE	Basic Electronics	3
2	OE	Microprocessors and Applications	3
3	OE	Industrial Electronics	3
4	OE	Signals and Systems	3
5	OE	Soft Computing Techniques	3
6	OE	Principles of Communications	3
7	OE	Digital Signal Processing	3
8	OE	Electronic measurement and Instrumentation	3

ACADEMIC REGULATIONS
(NRIA18)
COURSE STRUCTURE
AND
DETAILED SYLLABUS
(I YEAR)

ELECTRONICS AND COMMUNICATION ENGINEERING

For

B.Tech FOUR YEAR DEGREE COURSE
(Applicable from 2018-19 Batches)



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ACADEMIC REGULATIONS
COURSE STRUCTURE
AND
DETAILED SYLLABUS
(I YEAR)

ELECTRONICS AND COMMUNICATION ENGINEERING

For

B.Tech FOUR YEAR DEGREE COURSE

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

STRUCTURE FOR FIRST YEAR B.TECH PROGRAMME

I YEAR I SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	18A1100101	Professional English – I	2	1	-	3	40	60	100	3
2	18A1100201	Engineering Mathematics – I	2	1	-	3	40	60	100	3
3	18A1100205	Applied Chemistry	2	1	-	3	40	60	100	3
4	18A1102301	Fundamentals of Electrical Engineering.	2	1	-	3	40	60	100	3
5	18A1103301	Engineering Graphics	1	-	2	3	40	60	100	2
6	18A1100191	English Communication Skills lab – I	-	-	4	4	40	60	100	2
7	18A1100294	Applied Chemistry lab	-	-	2	2	40	60	100	1
8	18A1105391	Automation tools & Professional Workshop	-	-	2	2	40	60	100	1
Total			**9**	**4**	**10**	**23**	**320**	**480**	**800**	**18**

I YEAR II SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	18A1200101	Professional English – II	2	1	-	3	40	60	100	3
2	18A1200201	Engineering Mathematics – II	3	1	-	4	40	60	100	4
3	18A1200203	Applied Physics	2	1	-	3	40	60	100	3
4	18A1205301	Programming and Problem solving with C	3	1	-	4	40	60	100	4
5	18A1204401	Electronic Devices and Circuits	3	1	-	4	40	60	100	4
6	18A1200801	Environmental Studies	2	1	-	3	40	60	100	0
7	18A1200191	English Communication Skills lab – II	-	-	3	3	40	60	100	1.5
8	18A1200292	Applied Physics lab	-	-	2	2	40	60	100	1
9	18A1205392	Programming and Problem solving with C Lab	-	-	3	3	40	60	100	1.5
Total			**15**	**6**	**8**	**29**	**360**	**540**	**900**	**22**

L - LECTURE T – TUTORIAL P - PRACTICAL
CIA – Continuous Internal Assessment SEA – Semester End Assessment

PROFESSIONAL ENGLISH-I
(Common to CE,EEE,ME,ECE,CSE and IT)

Lecture – Tutorial: 2-1 Hours **Internal Marks:** 40
Credits: 3 **External Marks:** 60

Prerequisites:
None

Course Objectives:
1. To strengthen the lexical ability of the students in different contexts.
2. To expose the students to various sub-skills and strategies of reading and writing – summarizing and paraphrasing.
3. To help the students develop effective writing skills through paragraph writing.
4. To train the students in fundamentals of grammar required to equip them with fluent English.
5. To enable the students to think critically by exposing them to different socio-cultural contexts through various literary texts.

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

CO1	Use grammar accurately in various formal and functional contexts.
CO2	Build good vocabulary and develop the ability to use in various contexts.
CO3	Comprehend, analyze and evaluate texts critically.
CO4	Develop effective reading and writing skills to enhance communicative competence.
CO5	Help the students to inculcate and apply human values and professional ethics in their academic, professional and social lives.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2- Medium, 3 – High)

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

UNIT I

1. **Reading:** Introduction to Integrated Communication with emphasis on Reading Skills, Scanning an article from *The Economic Times* – **"Why India celebrates Engineers Day on the birth anniversary of M. Visvesvaraya"**
2. **Text: "I have a dream..."** - Martin Luther King
3. **Vocabulary Building:** Synonyms and Antonyms from the Text , Word Formations: Root Words, Prefixes and Suffixes
4. **Writing:** Styles of Sentence Structure for Effective Writing, Textual Exercises, Scrambled Sentences
5. **Remedial Grammar:** Parts of Speech, Effective Sentence Constructions Using Connectives

UNIT II

1. **Reading**: Skimming: **"Oh Father, Dear Father"** – Raj Kinger
2. **Text**: **"On Shaking Hands"** – A.G. Gardiner
3. **Vocabulary Building:** Synonyms and Antonyms from the Text
4. **Writing**: Paragraph Scramble
5. **Remedial Grammar:** Framing Questions and Question Tags, Punctuation Rules, Usage of Articles

UNIT III

1. **Reading**: Critical Reading: **"Dial 000"** - Barry Rosenberg
2. **Text**: **"Seeing People Off"** – Max Beerbohm
3. **Vocabulary Building**: Synonyms and Antonyms from the Text, Acronyms
4. **Writing**: Principles of a Good Paragraph
5. **Remedial Grammar**: Verbs and Types, Present Tense

UNIT IV

1. **Reading:** Note Making: **"Icons: The Lotus Temple"** – Anamika Bhutalia
2. **Text**: **"The Lost Child"** – Mulk Raj Anand
3. **Vocabulary Building:** Synonyms and Antonyms from the Text, One Word Substitutes
4. **Writing:** Summarising and Writing Anecdotes
5. **Remedial Grammar**: Past Tense and Future Tense, Correction of Sentences

REFERENCE BOOKS:

1. **The Blue Book of Grammar and Punctuation**, 10th Edition, Jane Straus, Josey-Bass, A Wiley Imprint.
2. **Oxford Practice Grammar,** John Eastwood, Oxford University Press.
3. **The Most Common Mistakes in English Usage** – Thomas Elliott Berry
4. **Essential Communication Skills** – Shalini Agarwal, Ane Books Pvt Ltd.
5. **Dictionary of Synonyms and Antonyms**, Oxford & IBH, III Ed
6. **A Practical English Grammar**, Agnes V. Martinet and Audrey Jean Thomson, Oxford University Press.

E-RESOURCES:

1. http://grammar.ccc.commnet.edu/grammar/index.htm
2. https://owl.english.purdue.edu/
3. https://www.britishcouncil.in/

ENGINEERING MATHEMATICS-1
((Common to CE,EEE,ME,ECE,CSE and IT)

Lecture – Tutorial: 2 – 1 **Internal Marks:** 40
Credits: 3 **External Marks:** 60

Prerequisites:

Fundamentals of Matrices, Fundamentals of Trigonometry and Calculus

Course Objectives:

- The course is designed to equip the students with the necessary skills and techniques that are essential for Engineering course.
- The skills derived from the course will help the student from a necessary base to develop analytic and design concepts.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

CO1	To solve simultaneous linear equations, determine eigen values, eigen vectors of a matrix and determine the nature of a Quadratic forms.
CO2	To calculate a root of algebraic and transcendental equations. Explain relation between the finite difference operators and compute the interpolating polynomial for the given data. Solve Ordinary differential equations numerically using Taylor series method, Euler's and RK method of second and fourth order.
CO3	To determine the Maxima and Minima of functions of Two variables without constraints and with constraints and form the Partial Differential equations by elimination of arbitrary constants and arbitrary functions.
CO4	To solve the ordinary linear differential equations by using Laplace Transforms.

Contribution of Course Outcomes towards achievement of Program Outcomes (1– Low, 2- Medium, 3 – High)

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

UNIT I:

Matrices

Rank – Echelon form – Normal form – PAQ form – Inverse of 4x4 matrix by Gauss-Jordan - Solution of Homogeneous linear systems – solution of Non-homogeneous linear systems – Gauss Elimination – Gauss Seidel methods.

Eigenvalues – Eigen vectors – Properties – Cayley Hamilton theorem (without proof) – Inverse Powers of Matrices by Caley Hamilton theorem – Quadratic forms – Reduction of quadratic forms to Canonical form (Congruent transformation method, Orthogonal transformation) – Rank, Index, Signature of a Quadratic form.

UNIT II

Numerical Methods

Solutions of Algebraic and Transcendental Equations: Bisection method – Iteration method – Newton Raphson method (one variable). Interpolation: Finite differences –Operators Δ, ∇, E and relations between them - Forward differences – Backward differences – Missing terms - Newton's forward and backward formulae for interpolation – Lagrange's interpolation formula.

Trapezoidal rule – Simpson's $1/3^{rd}$ and $3/8^{th}$ rules – Numerical solution of Ordinary differential equation by Taylor series method – Euler's method – Modified Euler's method – Rungekutta method of second and fourth order.

UNIT III

Partial Differentiation

Homogeneous function – Euler's theorem – Total derivative – Chain rule – Generalized mean value theorem for single variable (without proof) – Taylor's and Maclaurin's series – Expansion of Two variable functions – functional dependence – Jacobian – Maxima and Minima of functions of two variables without constraints and Lagrange's method of multipliers.

UNIT IV

Laplace Transforms

Laplace transforms of standard functions – shifting theorems – transforms of derivative's and integrals – Unit step function – Dirac's delta function.

Inverse laplace transforms - convolution theorem (without proof) – solving ordinary differential equations (Initial value problems) using Laplace transforms.

TEXT BOOKS:

1.B.S.Grewal, "Higher Engineering Mathematics, Khanna Publishers", 43rd Edition, 2014.

2.V.Ravindranath and P.Vijayalakshmi, Mathematical Methods, Himalaya Publishing House.

REFERENCE BOOKS:

1. **N.P.Bali**, Engineering Mathematics, Lakshmi Publications.

2. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India.

E-RESOURCES:

1.www.nptel**videos.com/mathematics/ (Math Lectures from MIT,Stanford,IIT'S)**

2.**nptel.ac.in/courses/122104017**

3.**nptel.ac.in/courses/111105035**

APPLIED CHEMISTRY

(Common to CSE,IT,ECE,EEE)

Lecture – Tutorial:	2-1	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites:

Course Objectives:

Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

CO1	Plastics have become part of our life. Hence their preparation, fabrication and study of properties are essential to engineering students.
CO2	Study of electrochemistry helps in developing efficient cells and batteries and thorough understanding of corrosion and its prevention.
CO3	With the increase in demand for power and also with depleting sources of fossil fuels, the demand for alternative sources of fuels is increasing. Some of the prospective fuel sources are introduced
CO4	Nano materials, superconductors and liquid crystals are advanced engineering materials with exceptional properties can be exploited by engineering students. The green synthesis must be understood to keep the planet earth safe.

Contribution of Course Outcomes towards achievement of Program Outcomes

(1 – Low, 2- Medium, 3 – High)

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

UNIT I

POLYMERS

Introduction-methods of polymerization-(emulsion and suspension)-physical and mechanical properties.

Plastics– Introduction-Thermoplastics and Thermosetting plastics – Compounding and fabrication (compression, injection, transfer & extrusion)-Preparation, properties and applications of polythene, PVC, Bakelite and Teflon

Elastomers: - Natural rubber- compounding and vulcanization – Synthetic rubbers: Buna S, Buna N and Thiokol– Applications of elastomers.

Fiber reinforced plastics – Biodegradable polymers – Conducting polymers.

UNIT II

ELECTROCHEMISTRY AND CORROSION

Galvanic cells - Reversible and irreversible cells – Single electrode potential – Electrochemical series and uses of this series- Standard Hydrogen electrode and Calomel electrode - Concentration Cells

Batteries: Dry Cell – Li- cells (Liquid cathode and solid cathode Li cells).
Fuel cells-Hydrogen-oxygen and methyl alcohol-oxygen fuel cells
Corrosion :- Definition – Theories of Corrosion (chemical & electrochemical) – Formation of galvanic cells by different metals, by concentration cells, by differential aeration and waterline corrosion – Passivity of metals – Pitting corrosion - Galvanic series – Factors which influence the rate of corrosion - Protection from corrosion – Cathodic protection – Protective coatings: Galvanizing, Tinning, Electroplating, Electro less plating.

UNIT III

NON CONVENTIONAL ENERGY SOURCES

Solar energy: Introduction, application of solar energy, conversion of solar energy(thermal and photo conversion)-photovoltaic cell: design, working
Hydro power include setup a hydropower plant (diagram)-Geothermal energy: introduction-design geothermal power plant-Tidal and wave power: Introduction-design and working-movement of tides and their effect on sea level-Ocean thermal energy: Introduction, closed cycle, open cycle, hybrid OTEC, diagram and explanation-.Biomass and bio fuels

UNIT IV

Chemistry of Advanced materials

Nano materials: Introduction –Sol- gel method &chemical reduction method of preparation-characterization by BET methods-carbon nano tubes and fullerenes: Types, preparation and properties and applications.
Liquid crystals: Introduction-Types-Applications.
Super conductors: definition-types-properties-application.
Semi conductors: Preparation of Semiconductors Si and Ge(two methods)
Green chemistry: principles-phase transfer catalyst method-supercritical fluid extraction methods

TEXT BOOKS:

1. Engineering Chemistry by Jain and Jain; Dhanpati Rai Publications
2. Engineering Chemistry by Shikha Agarwal; Cambridge University Press, 2015 edition.

REFERENCE BOOKS:

1. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014 edition (second).
2. Engineering Chemistry by Prasanth Rath, Cengage Learning, 2015 edition.
3. A text book of engineering Chemistry by S. S. Dara; S. Chand & Co Ltd., Latest Edition
4. Applied Chemistry by H.D. Gesser, Springer Publishers
5. Text book of Nano-science and nanotechnology by B.S. Murthy, P. Shankar and others, University Press, IIM

E-RESOURCES:

1.www.nptel.ac.in
2.www.swayam.gov.in

ENGINEERING MECHANICS

FUNDAMENTALS OF ELECTRICAL ENGINEERING
(Common to EEE,ECE)

Lecture – Tutorial:	3 – 1	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Course Objectives:
• To inculcate the understanding about the electrical fundamentals • To impart the basic knowledge about the Magnetic circuits • Identification of various components and Understanding the operation of CRO. • Understanding the importance of various sources and their Conversion.

Course Outcomes:	
Upon successful completion of the course, the student will be able to:	
CO1	Understand the importance of Electric circuits & Elements.
CO2	Understanding about the Magnetic Circuits.
CO3	Identification of various components and Understanding the operation of CRO.
CO4	Understanding the importance of various sources and their Conversion.

Contribution of Course Outcomes towards achievement of Program Outcomes (1– Low, 2- Medium, 3 – High)

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

UNIT I

Fundamentals of Electricity :

Introduction to circuit elements (R,L & C) – Electric current – Electric Potential difference – Ohm's law -Factors upon which Resistance depends – Specific Resistance – Effect of Temperature on Resistance – Temperature coefficient of Resistance – Series & parallel connection of Resistances , Inductances & Capacitances - Kirchhoff's laws (KCL & KVL)– Basic types of Sources (Independent Sources).

UNIT II

Protective Devices :

Types of Fuses, Characteristics , Materials Used, Fuse Rating – Types of Switches , Materials used, Symbols – Types of Circuit breakers - Types of Resistors , Rating – Colour coding of R,L & C

UNIT III

Earthing :

Need and Necessity of Earthing – Types of Earthing – Simple Earthing circuits for domestic appliances – Procedure of Earthing – Earthing of Generators, Motors, Transformers, Transmission Lines – Calculation earth resistance – Perfect Earthing - Importance of Neutral

Electrical Safety :

Electrical Shock – Types of First aids – Safety Norms – Human Body response for various electric voltages

UNIT IV

Measuring Instruments :

Types of Measuring Instruments – Principle of operation - Measurement of current, voltage, power, energy, Resistance, Inductance & capacitance – Earth Resistance – Principle of operation of CRO.

TEXT BOOKS:

1. Principles of Electrical Engineering by V.K Mehta, S.Chand Publications.

2. Elec., Technology by Edward Hughes

3. Electronic Principles by Sanjay Sharma , S.K.Katraia and Sons publications, 2nd edition

4. Electronics Devices and Circuits , S.Salivahanan ,N.Suresh Kumar,A.Vallava Raj, TMH publications , 4th edition

REFERENCE BOOKS:

1. Theory and Problems of Basic Electrical Engineering by D.P.Kothari & I.J. Nagrath PHI.

2. Basic Electrical Engineering by Fitzgerald and Higginbotham

3. Electrical Engineering fundamentals by Vincent Del Toro – PHI, New Delhi

E-RESOURCES:

1. http://nptel.ac.in/courses.php
2. http://jntuk-coeerd.in/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/

ENGINEERING GRAPHICS
(Common to EEE, ECE, CSE& IT)

Lecture – Practice:	1 – 2	**Internal Marks:**	40
Credits:	2	**Semester end assessment:** (Internal Only)	60

Prerequisites:

- Knowledge of basic mathematical concepts (Geometry)
- Drawing skills

Course Objectives:

- To introduce the students to use drawing instruments and to draw polygons, Engineering Curves.
- To introduce the students to use of orthographic projections, projections of points, lines & Lines inclined to both the planes.
- To make the students draw the projections of the planes and solids at various positions with reference planes.
- The student will be able to represent and convert the pictorial views to orthographic views and vice versa by using AutoCAD as well as conventional.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

CO1	Understand simple geometric construction like polygons, engineering curves and scales.
CO2	Understand orthographic projection of points, straight lines- inclined to one plane and inclined to both the planes.
CO3	Understand orthographic projection of planes and solids at various positions with different reference planes.
CO4	Understand The transformation of orthographic views into pictorial views and vice versa through AutoCAD as well as conventional drawing.

Contribution of Course Outcomes towards achievement of Program Outcomes (1– Low, 2- Medium, 3 – High)

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

UNIT I

Introduction to engineering drawing:

Polygons: Construction of regular polygons by general methods, inscribing and

describing polygons with circles.

Conics: Construction of Parabola, Ellipse and Hyperbola by using general methods and also draw tangents & normals for the curves.

UNIT II

Introduction to orthographic projections:

Projections of points and lines: Horizontal plane, vertical plane, profile plane, importance of reference planes, projections of points in various quadrants. Projections of straight lines- perpendicular lines, inclined lines and parallel to either of the reference planes(HP,VP or PP).

Projections of lines inclined to both the planes:

Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination .

UNIT III

Projections of planes: regular planes perpendicular/parallel to one plane and inclined to the other reference plane.

Projections of Solids: projections of Prisms, Pyramids, Cones and Cylinders with the axis parallel/perpendicular/ inclined to one of the planes and vice versa.

UNIT IV

Transformation of Projections: AutoCAD Fundamentals.

Conversion of Pictorial views to orthographic views Using AutoCAD and conventional.

Conversion of orthographic views to isometric views. Isometric drawing of simple objects through AutoCAD.

TEXT BOOKS:

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

REFERENCE BOOKS:

1. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by PI Varghese, McGrawHill Publishers
4. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age Publishers

E-RESOURCES:

2. http://nptel.iitm.ac.in/

ENGLISH COMMUNICATION SKILLS LAB-I

Practice:	4 Hours	**Internal Marks:**	40
Credits:	2	**External Marks:**	60

Prerequisites:

None

Course Objectives:

To enable the students to learn through practice the four communication skills: Listening, Speaking, Reading and Writing.

Understand the nuances of language usage for better presentation in all the walks of life promoting life-long learning.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the importance of communication skills and instill the need for life-long learning.
CO2	Express themselves fluently and appropriately in social and professional contexts.
CO3	Make sense of both verbal and non-verbal messages through selected listening activities.
CO4	Aware of the need of pronunciation and intonation in improving their speaking skills.

Contribution of Course Outcomes towards achievement of Program Outcomes

(1 – Low, 2- Medium, 3 – High)

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

List of Experiments:

UNIT 1:

1. Why study Spoken English?
2. Making Inquiries on the phone, thanking and responding to Thanks
3. Responding to Requests and asking for Directions

Practice work.

UNIT 2:

1. Asking for Clarifications, Inviting, Expressing Sympathy, Congratulating
2. Apologising, Advising, Suggesting, Agreeing and Disagreeing

Practice work.

UNIT 3:

1. Letters and Sounds
2. The Sounds of English

Practice work.

UNIT 4:

1. Pronunciation
2. Stress and Intonation

Practice work.

Equipment Required:

Computer Assisted Language Laboratory with computers equipped with software that help the students in developing four skills – Listening, Speaking, Reading and Writing.

Reference Books:

1. INTERACT: English Lab Manual for Undergraduate Students' Published by Orient Blackswan Pvt Ltd.
2. Strengthen your communication skills by Dr M Hari Prasad, Dr Salivendra Raju and Dr G Suvarna Lakshmi, Maruti Publications.
3. English for Professionals by Prof Eliah, B.S Publications, Hyderabad.
4. Unlock, Listening and speaking skills 2, Cambridge University Press
5. Spring Board to Success, Orient BlackSwan
6. A Practical Course in effective english speaking skills, PHI
7. Word power made handy, Dr shalini verma, Schand Company
8. Let us hear them speak, Jayashree Mohanraj, Sage texts
9. Professional Communication, Aruna Koneru, Mc Grawhill Education Cornerstone, Developing soft skills, Pearson Education

E-Resources:

1. https://www.britishcouncil.in/
2. http://www.talkenglish.com/

APPLIED CHEMISTRY LAB

Practice:	2	**Internal Marks:**	40
Credits:	1	**External Marks:**	60

Prerequisites:

Course Objectives:

To provide knowledge of chemistry practical's. It enables the students to analyze the different parameters of water sample like hardness and alkalinity and different volumetric titrations. It makes the students to obtain basic knowledge of instrumentation based on different Engineering applications.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

CO1	Perform different volumetric titrations listed in syllabus.
CO2	To analyze various parameters of water sample.
CO3	Instrumental methods of chemical analysis exhibit the skill of the students.
CO4	Preparation of different compounds provides knowledge to the students.

Contribution of Course Outcomes towards achievement of Program Outcomes

(1 – Low, 2- Medium, 3 – High)

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

List of Experiments:

1.Determination of HCl by Na_2CO_3 solution

2.Determination of alkalinity of sample containing Na_2CO_3 and NaOH

3.Determination of $KMnO_4$ using standard oxalic acid solution

4.Determination of total hardness of water by EDTA solution

5.Determination of copper using standard EDTA solution

6.Determination of Zinc using standard EDTA solution

7.Determination of Iron by a calorimetric method

8.Conductometric titration between strong acid and strong base

9.Potentiometric titration between strong acid and strong base

10.Potentiometric titration between Iron and dichromate

Additional Experiments to be performed

1.Preparation of urea-formaldehyde resin

2.Determination of P^H of water sample

3. Preparation of phenol-formaldehyde resin

EQUIPMENT REQUIRED:

PH meters, Potentiometers, Conductometers, colorimeters.

APPARATUS

Burettes, Pipettes, Conical flask, Beakers.

REFERENCE BOOKS:

1 . A Textbook of Quantitative Analysis, Arthur J. Vogel.

2. Dr. Jyotsna Cherukuri (2012) *Laboratory Manual of engineering chemistry-II,* VGS Techno Series

3. Chemistry Practical Manual, Lorven Publications

4. K. Mukkanti (2009) *Practical Engineering Chemistry,* B.S. Publication

AUTOMATION TOOLS & PROFESSIONAL WORKSHOP

Practice:	2	**Internal Marks:**	40
Credits:	1	**External Marks:**	60

Prerequisites: Knowledge of information technology workshop

Course Objectives:

1. Understand the basic components and peripherals of a computer.
2. To become familiar in configuring a system.
3. Learn the usage of productivity tools
4. Acquire knowledge about the netiquette and cyber hygiene
5. Get hands on experience in trouble shooting a system

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

CO1	Understand and Apply MS Office tools
CO2	Configure the components on the motherboard and install different operating systems
CO3	Understand and configure different storage media
CO4	Identified strategies for overcoming constraints to effective decentralization and sustainable management at different levels

Contribution of Course Outcomes towards achievement of Program Outcomes

(1 – Low, 2 - Medium, 3– High)

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

List of Experiments: 10

1.Identification of the peripherals of a computer: To prepare a report containing the block diagram of the CPU along with the configuration of each peripheral and its functions. Description of various I/O Devices

2.System Assembling, Disassembling: A practice on disassembling the components of a PC and assembling them to back to working condition.

3.Operating System Installation-Install Operating Systems like Windows, Linux along with necessary Device Drivers.

4.MS-Office / Open Office

a. Word - Formatting, Page Borders, Reviewing, Equations, symbols.
b. Spread Sheet - organize data, usage of formula, graphs, charts.
c. Power point - features of power point, guidelines for preparing an effective presentation.
d. Access- creation of database, validate data

5. Network Configuration & Software Installation-Configuring TCP/IP, proxy and firewall settings. Installing application software, system software & tools.

6. Internet and World Wide Web-

Cyber Hygiene (Demonstration): Awareness of various threats on the internet. Importance of security patch updates and anti-virus solutions. Ethical Hacking, Firewalls, Multi-factor authentication techniques including

Smartcard, Biometrics are also practiced

7.Search Engines & Netiquette:

Students are enabled to use search engines for simple search, academic search and any other context based search (Bing, Google etc). Students are acquainted to the principles of micro-blogging, wiki, collaboration using social networks, participating in online technology forums

8. Trouble Shooting-Hardware trouble shooting, Software trouble shooting.

Hardware Troubleshooting (Demonstration): Identification of a problem and fixing a defective PC(improper assembly or defective peripherals).

Software Troubleshooting (Demonstration):. Identification of a problem and fixing the PC for any software issues

9. MATLAB- basic commands, subroutines, graph plotting.

10. LATEX-basic formatting, handling equations and images.

EQUIPMENT REQUIRED:

1. Physical components of computer

REFERENCE BOOKS:

1. Computer Hardware, Installation, Interfacing, Troubleshooting and Maintenance, K.L. James, Eastern Economy Edition.
2. Microsoft Office 2007: Introductory Concepts and Techniques, Windows XP Edition by Gary B. Shelly, Misty E. Vermaat and Thomas J. Cashman (2007, Paperback).
3. LATEX- User's Guide and Reference manual, Leslie Lamport, Pearson, LPE, 2/e.
4. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers, Rudraprathap, Oxford University Press, 2002.
5. Workshop Manual prepared by NRIIT staff

E-RESOURCES:

1.http://nptel.iitm.ac.in
2.JNTUK-COERD

VIRTUAL LAB:

1. http://vlab.amrita.edu/?sub=1&brch=201&sim=366&cnt=1
2. http://vlab.amrita.edu/?sub=1&brch=195&sim=840&cnt=1
3. http://vlab.amrita.edu/?sub=1&brch=282&sim=879&cnt=1

PROFESSIONAL ENGLISH-II
(Common to CE,EEE,ME,ECE,CSE and IT)

Lecture – Tutorial:	2-1	**Internal Marks:**	40
Credits:	3	**External Marks:**	60
Prerequisites:			

Course Objectives:

1. To expose the students to components of grammar required in effective sentence constructions.
2. To help the students to develop effective writing skills using phrasal verbs, connectives, collocations, idioms etc.
3. To enable the students to learn the format, style and types of letters, reports and emails.
4. To expose the students to various sub skills and strategies of reading and writing.
5. To enable the students to analyse and evaluate various texts that lead to global comprehension.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Recognize the importance of the role of communication in the competitive world.
CO2	Acquire the competence to write effectively in various formal and academic contexts.
CO3	Acquire the jargon used in business communication and technical communication.
CO4	Develop the ability to evaluate texts by inferring the implied sense of such texts and apply such knowledge globally.
CO5	Gain knowledge about the significance of the universal human values through expression of human feelings of compassion and right understanding.

Contribution of Course Outcomes towards achievement of Program Outcomes

(1 – Low, 2- Medium, 3 – High)

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

UNIT I

1. **Text**: A. **"The Struggle for an Education"** – Booker T. Washington
   B. **"Good Manners"** – J.C. Hill
2. **Writing**: Formal Communication VS Informal Communication -Writing
3. **Vocabulary**: Business and Technical Terminology
4. **Remedial Grammar**: Change of Voice

UNIT II

1. **Text**: **"A Letter to Indu"** – Jawaharlal Nehru
2. **Writing**: Letter Writing – Types of Letters – Different Styles of Letter Writing
3. **Vocabulary**: Phrasal Verbs – Use of Connectives in Sentence Constructions
4. **Remedial Grammar**: Reported Speech

UNIT III

1. **Text**: A. **"The Power of a Plate of Rice"** – Ifeoma Okoye
   B. **"Email to Employees"** – Satya Nadella
2. **Writing**: Email Writing, Report Writing (Significance, Format and style of writing Technical Reports)
3. **Vocabulary**: Collocations
4. **Remedial Grammar:** Subject-Verb Agreement

UNIT IV

1. **Text**: **"Stench of Kerosene"** – Amrita Pritam
2. **Writing**: Essay Writing –Types of Essays
3. **Vocabulary**: Use of Idiomatic Expressions (in different contexts)
4. **Remedial Grammar**: Common Errors

TEXT BOOKS:

REFERENCE BOOKS:

1. Advanced Grammar in Use. Martin Hewings. Cambridge University Press. 2013
2. Effective Technical Communication Rizvi, Ashraf. M.. Tata McGraw – Hill, New Delhi. 2005
3. Word Power Made Easy. Norman Lewis
4. Michael Swan. Basic English Usage
5. A New Approach to Objective English. Dhillon Group of Publications
6. English and Soft Skills. Dhanavel S. P. Orient Black Swan, Hyderabad, 2010
7. Professional Communication. Baradwaj Kumkum. I.K. International Publishing House Pvt. Ltd, New Delhi .2008
8. Intermediate English Grammar, Raymond Murphy, Cambridge University Press.

E-RESOURCES:

1. http://grammar.ccc.commnet.edu/grammar/index.htm
2. https://owl.english.purdue.edu/
3. https://learnenglish.britishcouncil.org/en

ENGINEERING MATHEMATICS-II
(Common to CE,EEE,ME,ECE,CSE and IT)

Lecture – Tutorial:	3 – 1	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

Prerequisites:
Student has a knowledge about Trigonometric functions and its related formulae, Differentiation , Integration and vector algebra.

Course Objectives:

- The course is designed to equip the students with the necessary skills and techniques that are essential for Engineering course.
- The skills derived from the course will help the student from a necessary base to develop analytic and design concepts.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:	
CO1	Finding the General solution of first order ordinary differential equation and its applications.
CO2	Finding the General solution of second and higher order ordinary differential equations with constant and variable coefficients.
CO3	Determine double integral over a region and triple integral over a volume.
CO4	Determine the Gradient, Diveregence and Curl of a vector and vector identities.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1– Low, 2- Medium, 3 – High)

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

UNIT I

Ordinary differential equations of first order and applications

Linear – Bernoulli – Exact – Reducible to exact differential equations – Ort trajectories –
Newton's law of cooling – Law of exponential growth and decay .

UNIT II

Ordinary differential equations of 2nd and higher order

Non homogeneous equations of higher order with constant coefficients with Right hand side terms of the type $e^{ax}, \sin ax, \cos ax, x^k (k > 0), e^{ax}V, x^mV$ - Variation of parameters – Differential equations with variable coefficients (Legendre and Cauchy)

UNIT III

Multiple Integrals

Multiple Integrals – Double and Triple Integrals – Change of variables – Change of integration.

Applications: Finding Areas, Surfaces and Volumes.

UNIT IV

Vector Calculus

Vector differentiation – Gradient – Divergence – Curl – Vector identies.

Vector Integration – Line integral – work done – Potential function – area – surface and volume integrals – Vector integral theorems (without proof) viz. Greens, stokes and Gauss divergence and related problems.

TEXT BOOKS:

1.B.S.Grewal, "Higher Engineering Mathematics, Khanna Publishers", 43rd Edition, 2014.

REFERENCE BOOKS:

1. **N.P.Bali**, Engineering Mathematics, Lakshmi Publications.

2. **Erwin Kreyszig,** Advanced Engineering Mathematics, 10th Edition, Wiley-India

E-RESOURCES:

1.www.nptel**videos.com/mathematics/ (Math Lectures from MIT,Stanford,IIT'S)**

2.**nptel.ac.in/courses/122104017**

3.**nptel.ac.in/courses/111105035**

APPLIED PHYSICS

(Common to ECE, CSE, EEE & IT)

Lecture – Tutorial:	2-1	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Knowledge of Optics & Electromagnetism

Course Objectives: 1. To provide a bridge between Basic Physics and Engineering Physics.

2.To Create the awareness of various phenomena of physics which in turn help the students in future engineering applications

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

CO1	Impart Knowledge of Physical Optics phenomena like Interference, Diffraction and Polarization involving required to design instruments with higher resolution.
CO2	Teach Concepts of coherent sources, its realization and utility optical instrumentation. Apply the concepts of light in optical fibers, light wave communication systems, and for sensing physical parameters
CO3	Study the concepts regarding the bulk response of materials to the EM fields and their analytically study in the back-drop of basic quantum mechanics.
CO4	Understand the physics of Semiconductors and their working mechanism for their utility in sensors

Contribution of Course Outcomes towards achievement of Program Outcomes

(1 – Low, 2- Medium, 3 – High)

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

UNIT I

Interference: Introduction - Interference in thin films (reflection geometry) – Newton's rings – construction and basic principle of Interferometers.

Diffraction: Introduction – Rayleigh Criterion - Resolving power of a grating, Telescope and Microscopes.

Polarization: Introduction - Types of Polarization –Double Refraction - Nicol Prism -Quarter wave plate and Half Wave plate.

UNIT-II

Lasers: Introduction - Characteristics of Laser, Absorption, spontaneous emission, Stimulated emission Lasing action, Relation between Einstein Coefficients, Population Inversion, Pumping Schemes: 3- level&4- level lasers, Pumping methods. Components of laser devices, Ruby Laser, He-Ne Laser, Applications.

Fibre Optics: Principle of optical fibre, Structure – Numerical aperture and acceptance angle,

Types of optical fibers – based on Material, refractive index profile, Modes of propagation (Single & Multimode Fibres), Propagation of signal through optical fibre, Applications.

UNIT III

EM fields: Basic laws of electro magnetism, Maxwell's equations (Differential form only) - propagation of EM wave in dielectric medium – Poynting Vector.

Quantum Mechanics: Introduction - Matter waves – Schröedinger Time Independent and Time Dependent wave equations – Particle in a box.

Free Electron Theory: Introduction - Defects of Classical free electron theory – Quantum Free electron theory - concept of Fermi Energy – Density of States

UNIT IV

Band Theory of Solids: Bloch's theorem – Kronig – Penney model (qualitative) – energy bands in crystalline solids – classification of crystalline solids– effective mass of electron & concept of hole.

Semi-Conductor Physics: Conduction – Density of carriers in Intrinsic and Extrinsic semiconductors – Drift & Diffusion – relevance of Einstein's equation- Hall effect.

TEXT BOOKS:

4. A text book of Engineering physics by Dr.M.N.Avadhanulu And Dr. P.G Kshir sagar,Schand &Company Ltd (2017)
5. P.K.Palanisamy, Engineering Physics, Sci Tech, Chennai
6. Engineering Physics, 2nd Edition, H.K.Malik & A.K.Singh, Mc Graw Hill Education, Chennai

REFERENCE BOOKS:

3. Solid State Physics by A.J.Dekkar, Mac Millan Publishers
4. Ajoy Ghatak, Optics, 2nd Ed., Tata McGraw Hill, 1994

E-RESOURCES:

1.NPTEL

2.www.doitpoms.ac.uk

PROGRAMMING AND PROBLEM SOLVING WITH C
(Common to CIVIL,EEE,MECH,ECE)

Lecture – Tutorial:	3-1	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

Prerequisites:

. Basic Knowledge on computer usage

.Basic knowledge on Mathematics

Course Objectives:

Formulating algorithmic solutions to problems and implementing algorithms in C.

- Notion of Operation of a CPU, Notion of an algorithm and computational procedure,
  editing and executing programs in Linux.
- Understanding branching, iteration and data representation using arrays.
- Modular programming and recursive solution formulation.
- Understanding pointers and dynamic memory allocation.
- Understanding miscellaneous aspects of C.
- Comprehension of file operations.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

CO1	Understanding basic terminologies, basic idea on writing, executing programs, understanding decision structures.
CO2	Design programs involving Arrays, modular programming concepts
CO3	Understand the use of Pointers and Strings
CO4	Use different data structures and create/update basic data files.

Contribution of Course Outcomes towards achievement of Program Outcomes

(1 – Low, 2- Medium, 3 – High)

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

UNIT I

Introduction to Programming: Computer - Components, Types of Languages, Compiler, Algorithms and their representations: Flowcharts, Pseudo Code.

Introduction to C: "Hello World" in C – Editor, Compiler, Execution Environment. C as a Middle Level Language. Basic Structure of C program, Standard Library and Header Files, Tokens in C - Variable, Constant (literal and named), Data types, Keywords, Variable Declaration and Assignment. Operators - Precedence & Associativity. Type conversion, Input and Output statements.

Selection and Looping Statements: If statement, If-Else Statement, Nested If, Examples, Multi-way selection: Switch, Else-If, examples, While Statement, For Statement, Nested Loops, do-while Statement, Break and Continue statements, Example programs

UNIT II

Arrays: Concept, Declaration and Initialization of Arrays, Accessing Individual Elements of Array. Use of Arrays in Sorting, Searching. Concept of 2-D array (Matrix), Passing arrays to functions, Examples.

Functions: Need of Functions, Function Declaration, Definition and Call. Inbuilt functions and User Defined Functions. Passing arguments to a function, Returning values from a function. Scope of variable, local and global variable. Storage classes.

Recursive Functions: Need of Recursion, Direct Recursion, Indirect Recursion, Examples of Recursive Programs – Factorial, Fibonacci series. Recursive Vs Iterative solutions,Disadvantages of Recursion.

UNIT III

Pointers: Concept of Pointers, Relevance of Data type in Pointer Variable, Pointer arithmetic. Pointer to pointer. Pointers and Functions (passing pointers to functions, returning pointers from functions). Pointers and Arrays. Pointers and Strings. Array of Pointers, Pointer to Array. Various alternatives of accessing arrays (1-D and 2-D) using pointers, Dynamic Memory Allocation ,Command Line Arguments

Strings: Strings as Arrays, Character Array versus Strings, Reading Strings, Writing Strings, User Defined Functions for String Operations – Copy, Concatenate, Length, Reverse, Converting case, Appending, Comparing two strings, Extracting a substring. Array of strings.

UNIT IV

Structures & Unions: Notion, Declaration and Initialization, Structure Variables, Accessing and Assigning values of the fields, Functions and Structures, Arrays of Structures, nested structures, Pointers and Structures, Passing Structure to a Function and Returning Structure from Function. Introduction to self referential structures , Union, Nesting of Structure and Union. Enumerated data types.

Data Files: Declaring, Opening and Closing File Streams, Reading From and Writing to Text Files, Random File Access

TEXT BOOKS:

1. C Programming-A Problem Solving Approach, Forouzan, Gilberg, Cengage

REFERENCE BOOKS:

1.Programming in ANSIC 7th Edition by E.Balaguruswamy
2.Let us C by Yaswanth Kanetkar
3. The C programming Language, Dennis Richie and Brian Kernighan, Pearson Education.
4. Programming with C, Bichkar, Universities Press.
5. Programming in C, ReemaThareja, OXFORD.
6. C by Example, Noel Kalicharan, Cambridge.
7. ANSI C Programming, Gary J. Bronson, Cengage Learning.

E-RESOURCES:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-087-practical-programming-in-c-january-iap-2010/lecture-notes/
2. http://cslibrary.stanford.edu/101/EssentialC.pdf
3. http://nptel.ac.in/courses/106104128/
4. http://www.vssut.ac.in/lecture_notes/lecture1424354156.pdf

ELECTRONIC DEVICES & CIRCUITS

Lecture – Tutorial:	3-1	**Internal Marks:**	25
Credits:	4	**External Marks:**	75

Prerequisites:

- Basic Knowledge in Semiconductors.
- Knowledge about Circuits Construction.
- Knowledge on Networks and Current components

Course Objectives:

- The concept of Semiconductor Diodes are to be reviewed and to study transport mechanism.
- Application of diodes as rectifies with their operation with and without filters to be designed.
- Principal of Transistor working and its biasing methods are to study.
- Construction working and operation of FET's with MOSFET's to be studied.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

CO1	Understand Semiconductor Technology and gain knowledge about various diodes.
CO2	Have knowledge about diode applications , rectifiers and filter design.
CO3	Have sound knowledge about transistor and its biasing design.
CO4	Gains knowledge about FET's and MOSFET operations.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

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

UNIT I

SEMICONDUCTOR DIODE CHARACTERISTICS IN SPECIAL DEVICES:

Qualitative Theory of P-N Junction, P-N Junction as Diode, Current Components in a Diode, Quantitative theory of diode equation ,Volt-Ampere Characteristics, Diode Resistance, -Quantitative theory of Transition and Diffusion Capacitance ,Break down in a diode , Problems.

SPECIAL DEVICES:

Operation and Characteristics of Zener Diode, Tunnel Diode, Varactor Diode, Photo Diode, PIN Diode, LED and SCR

UNIT II

UNIT-II

RECTIFIERS AND FILTERS:

Introduction to Power supplies, Rectifiers – Qualitative treatment of Half Wave rectifier, Qualitative treatment of Full Wave rectifier, Quantitative treatment Bridge rectifier and related problems.

FILTERS AND REGULATORS:

Introduction to Filters, types of filters and their significance, Qualitative treatment of - Capacitive Filter, Inductor Filter, L-*Section, Π*-Section single and multiple, Voltage Regulator using Zener Diode, Related Problems.

UNIT III

BIPOLAR JUNCTION TRANSISTOR, BIASING AND STABILIZATION:

Introduction To Bipolar Transistor, Construction Operation of BJT, Working Of P-N-P and N-P-N Transistors, BJT as Amplifier and Switch, Transistor Current Components- Input-Output Characteristics of BJT in *CE,CB,CC Configurations, Relation Between α, β, γ.*

STABILIZATION & BIASING:

BJT Biasing Techniques, Need for Biasing, Operating Point, DC & AC Load Line Analysis, Types of Biasing, Stability Factors of Biasing, Thermal Runaway, Heat Sinks, Thermal Stabilizations, Diode Compensation Techniques

UNIT IV

JUNCTION FIELD EFFECT TRANSISTOR & MOSFET's:

Introduction to J-FET, Types of J-FET, V-I Characteristics of J-FET in CS Configuration, FET as an Amplifier, J-FET Biasing.

MOSFET's:

MOSFET's Construction, Operation & Characteristics, Enhancement & Depletion Mode MOSFET, UJT Construction, working and its characteristics, UJT as Relaxation Oscillator

TEXT BOOKS:

1) **Jacob Millman, Christos C.Halkias And Satyabrata Jit, Electronic Devices And Circuits, Mc Graw Hill, 3rd Edition , 2010.**
2) **S. Salivahanan, N. Kumar And A. Vallavaraj, Electronic Devices And Circuits, Mc Graw Hill, 2rd Edition , 2007**

REFERENCE BOOKS:

1) 1. **R.L.Boylestad And Louis Nashelsky, Electronic Devices And Circuits, Pearson/Prentice Hall Publishers.**
2) **David A.Bell, Electronic Devices And Circuits, Oxford University Press, 5th Edition, 2008.**
3) **Micro Electronic Circuits, Sedra Smith, Oxford Press, India(5/E), Oxford, 2004**
4) **Electronic Devices And Circuits- K.Satya Prasad , Vgs Booklinks**

E-RESOURCES:

1.Moocks
2.NPTEL
3. Course era

ENVIRONMENTAL STUDIES
(Common to CE,EEE,ME,CSE and IT)

Lecture – Tutorial:	2-1	**Internal Marks:**	40
Credits:	--	**External Marks:**	60

Prerequisites:

Course Objectives:

- Basic understanding of ecosystem and to know the importance of biodiversity.
- Understanding of natural resources.
- To understand different types of pollutants effecting the environment.
- To know global environmental problems, problems associated with over population and burden on environment.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

CO1	Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
CO2	Understand the role of natural resources for the sustenance of life on earth and recognize the need to conserve them.
CO3	Identify the environmental pollutants and abatement devices.
CO4	Gain the importance of sustainability.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2- Medium, 3 – High)

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

UNIT I

Ecosystems: Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Ecological succession. – Food chains, food webs and ecological pyramids, flow of energy, biogeochemical cycles.

Biodiversity and its conservation: Definition: genetic, species and ecosystem diversity- classification - Value of biodiversity, India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts - Endangered and endemic species of India – Conservation of biodiversity.

UNIT II

Natural Resources: Natural resources and associated problems
Forest resources – Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.
Water resources – Use and over utilization of surface and ground water –

Floods, drought, conflicts over water, dams – benefits and problems.
Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources. Case studies.
Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources Vs Oil and Natural Gas Extraction.
Land resources: land as a resource, land degradation, wasteland reclamation, man induced landslides, soil erosion and desertification.
Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT III

Environmental Pollution: Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards, Technological solutions for pollution control, Role of an individual in prevention of pollution with case studies.
Solid Waste Management: Sources, Classification, effects and control measures of urban andindustrial solid wastes. Biomedical, Hazardous and **E–waste** management, carbon credits.
Disaster management: floods, droughts, earthquakes, cyclones.

UNIT IV

Social issues and the environment: Global environmental challenges- global warming and climate change, acid rains, ozone layer depletion.
Towards sustainable future: From unsustainable to sustainable development, population and its explosion, urban problems related to energy, rain water harvesting, consumerism and waste products, role of IT in environment and human health, HIV/ AIDS, environmental ethics.
Environmental management and acts: Impact assessment and significance, various stages of EIA, environmental management plan (EMP), green belt development. Environmental Law (Air, Water, Wildlife, Forest, Environment protection act).
The student should visit an industry/ Ecosystem and submit a report individually on any issues related to environmental studies course and make a power point presentation.

TEXT BOOKS:

1. Environment Studies, Anubha Kaushik, C P Kaushik, New Age International Publishers, 2018
2. Environmental Studies, R. Rajagopalan, 2nd Edition, 2011, Oxford University Press.
3. Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

REFERENCE BOOKS:

1. Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada.
3. Erach Bharucha, 2010 " Text Book of Environmental Studies" , University Grants Commission, University Press (India) Pvt. Ltd., Hyderabad.
4. Text book of Environmental Science and Engineering by G. Tyler Miller Jr, 2006 Cengage learning.

E-RESOURCES:

1. http://nptel.ac.in/courses.php.
2.http://jntuk-coeerd.in/

ENGLISH COMMUNICATION SKILLS LAB-II

Practice:	3	**Internal Marks:**	40
Credits:	1.5	**External Marks:**	60

Prerequisites:

Course Objectives:

To enable the students to learn through practice the four communication skills: Listening, Speaking, Reading and Writing.

Understand the nuances of language usage for better presentation in all the walks of life promoting life-long learning.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Attain better understanding of the nuances of English language to put into use in various situation and events.
CO2	Acquire speaking skills with clarity and confidence which in turn enhances their employability skills.
CO3	Communicate and present their ideas and sources accurately and effectively.
CO4	Enhance their employability skills and critical thinking skills with participation in mock interviews and group discussions.

Contribution of Course Outcomes towards achievement of Program Outcomes

(1 – Low, 2- Medium, 3 – High)

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

List of Experiments:

UNIT 1:

1. Debating

Practice work

UNIT 2:

1. Group Discussions

Practice work

UNIT 3:

1. Presentation Skills

Practice work

UNIT 4:

1. Interview Skills
2. Curriculum Vitae

Practice work

EQUIPMENT REQUIRED:

Computer Assisted Language Laboratory with computers equipped with software that help the students in developing four skills – Listening, Speaking, Reading and Writing.

REFERENCE BOOKS:

1. INTERACT: English Lab Manual for Undergraduate Students' Published by Orient Blackswan Pvt Ltd.
2. Strengthen your communication skills by Dr M Hari Prasad, Dr Salivendra Raju and Dr G Suvarna Lakshmi, Maruti Publications.
3. English for Professionals by Prof Eliah, B.S Publications, Hyderabad.
4. Unlock, Listening and speaking skills 2, Cambridge University Press
5. Spring Board to Success, Orient BlackSwan
6. A Practical Course in effective english speaking skills, PHI
7. Word power made handy, Dr shalini verma, Schand Company
8. Let us hear them speak, Jayashree Mohanraj, Sage texts
9. Professional Communication, Aruna Koneru, Mc Grawhill Education
10. Cornerstone, Developing soft skills, Pearson Education

E-RESOURCES:

1. 1. https://www.britishcouncil.in/
2. http://www.talkenglish.com/

APPLIED PHYSICS LAB

Practice:	2	**Internal Marks:**	40
Credits:	1	**External Marks:**	60

Prerequisites: Knowledge of Vernier Calipers, Screw Gauge

Course Objectives: Training field oriented Engineering graduates to handle instruments and their design methods to improve the accuracy of measurements.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

CO1	Calculate wavelengths of various light sources, thickness of the given object and radius of curvature of lens.
CO2	Determine Numerical Aperture & bending losses of Optical Fibre
CO3	Analyze the characteristics and energy band gaps of semi-conductor and zener diodes
CO4	Estimate the frequency of tuning fork and Magnetic field strength.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

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

List of Experiments:

13. Determination of wavelength of a source-Diffraction Grating-Normal incidence
14. Newton's rings – Radius of Curvature of Plano - Convex Lens
15. Determination of thickness of a spacer using wedge film and parallel interference fringes. .
16. Determination of wavelength of laser source using diffraction grating.
17. Determination of Numerical Aperture of an Optical Fibre.
18. Study of I/V Characteristics of Semiconductor diode.
19. I/V characteristics of Zener diode.
20. Energy Band gap of a Semiconductor p - n junction
21. Meldi's experiment – Transverse and Longitudinal modes.
22. Magnetic field along the axis of a current carrying coil – Stewart and

Gee's apparatus

23. Verification of laws of vibrations in stretched strings – Sonometer

24. L- C- R Series Resonance Circuit.

EQUIPMENT REQUIRED:

10. Spectrometer
11. Travelling Microscope
12. Regulated Power Supply
13. Function Generators
14. Energy Band Gap Kit
15. Digital Mutlimetres
16. Tuning Forks
17. Electrically driven Tuning Forks
18. Tangent Galvanometer

REFERENCE BOOKS:

1. Lab Manual of Engineering Physics by Dr.Y.Aparna & Dr.K.Venkateswara Rao (VGS Books Links, Vijayawada)

E-RESOURCES:

1.www.vlab.co.in

PROGRAMMING AND PROBLEM SOLVING WITH C LAB

Practice:	3	**Internal Marks:**	40
Credits:	1.5	**External Marks:**	60

Prerequisites:

Course Objectives:

- Understand the basic concept of C Programming, and its different modules that includes conditional and looping expressions, Arrays, Strings, Functions, Pointers, Structures and File programming.
- Acquire knowledge about the basic concept of writing a program.
- Role of constants, variables, identifiers, operators, type conversion and other building blocks of C Language.
- Use of conditional expressions and looping statements to solve problems associated withconditions and repetitions.
- Role of Functions involving the idea of modularity.

COURSE OUTCOMES:

Upon successful completion of the course, the student will be able to:

CO1	Understand C programming development environment, compiling, debugging, and linking and executing a program using the development environment
CO2	To solve the problems using selection and iterative statements
CO3	Analyzing the complexity of problems, Modularize the problems into small modules and then convert them into programs, Understand and apply the in-built functions and customized functions for solving the problems.
CO4	To solve the various problems using arrays, structures, pointers and files

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

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

List of Experiments:

Exercise - 1 Basics

a) What is an OS Command, Familiarization of Editors - vi, Emacs

b) Using commands like mkdir, ls, cp, mv, cat, pwd, and man

c) C Program to Perform Adding, Subtraction, Multiplication and Division of two numbers From

Command line

Exercise - 2 Basic Math

a) Write a C Program to Simulate 3 Laws at Motion

b) Write a C Program to convert Celsius to Fahrenheit and vice versa

Exercise - 3 Control Flow - I

a)Write a C Program to Find Whether the Given Year is a Leap Year or not.

b)Write a C Program to Add Digits & Multiplication of a number

Exercise – 4 Control Flow - II
a)Write a C Program to Find Whether the Given Number is
i) Prime Number
ii) Armstrong Number
b) Write a C program to print Floyd Triangle
c) Write a C Program to print Pascal Triangle
Exercise – 5 Functions
a) Write a C Program demonstrating of parameter passing in Functions and returning values.
b) Write a C Program illustrating Fibonacci, Factorial with Recursion without Recursion
Exercise – 6 Control Flow - III
a) Write a C Program to make a simple Calculator to Add, Subtract, Multiply or Divide Using
switch...case
b) Write a C Program to convert decimal to binary and hex (using switch call function the
function)
Exercise – 7 Functions - Continued
Write a C Program to compute the values ofsin x and cos x and e^x values using Series
expansion. (use factorial function)
Exercise – 8 Arrays
Demonstration of arrays
a) Search-Linear.
b) Sorting-Bubble, Selection.
c) Operations on Matrix.
Exercises - 9 Structures
a)Write a C Program to Store Information of a Movie Using Structure
b)Write a C Program to Store Information Using Structures with Dynamically Memory
Allocation
c) Write a C Program to Add Two Complex Numbers by Passing Structure to a Function
Exercise - 10 Arrays and Pointers
a)Write a C Program to Access Elements of an Array Using Pointer
b) Write a C Program to find the sum of numbers with arrays and pointers.
Exercise – 11 Dynamic Memory Allocations
a) Write a C program to find sum of n elements entered by user. To perform this program,
allocate memory dynamically using malloc () function.
b) Write a C program to find sum of n elements entered by user. To perform this program,
allocate memory dynamically using calloc () function. Understand the difference between the
above two programs
Exercise – 12 Strings
a) Implementation of string manipulation operations with library function.
i) copy
ii) concatenate
iii) length
iv) compare

b) Implementation of string manipulation operations without library function.
i) copy
ii) concatenate
iii) length
iv) compare
Exercise -13 Files
a)Write a C programming code to open a file and to print it contents on screen.
b)Write a C program to copy files
Exercise - 14 Files Continued
a) Write a C program merges two files and stores their contents in another file.
b) Write a C program to delete a file.

EQUIPMENT REQUIRED:

1.Computer Systems with UNIX OS,GCC Compiler,VI Editor

REFERENCE BOOKS:

1. 1.Programming in ANSIC 7th Edition by E.Balaguruswamy
2.Let us C by Yaswanth Kanetkar
3. The C programming Language, Dennis Richie and Brian Kernighan, Pearson Education.

E-RESOURCES:

1. http://www.skiet.org/downloads/cprogrammingquestion.pdf
2. http://www.c4learn.com/c-programs/
3. https://www.programiz.com/c-programming/examples
4. https://www.sanfoundry.com/c-programming-examples/

NRI INSTITUTE OF TECHNOLOGY

An Autonomous Institution, Permanently Affiliated to JNTUK, Kakinada
(Accredited by NAAC with "A" Grade and ISO 9001:2015 Certified Institute)
Pothavarappadu (V), Via Nunna, Agiripalli (M), PIN-521 212.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE STRUCTURE FOR II YEAR B.TECH PROGRAMME-NRIA 18

II B.TECH I-SEMESTER

S. No	CC	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1		Complex Variables & Transform Techniques	3	-	-	3	40	60	100	3
2		Network analysis & Transmission Lines	3	-	-	3	40	60	100	3
3		Digital Electronics & Logic Design	3	-	-	3	40	60	100	3
4		Signals and Systems	3	-	-	3	40	60	100	3
5		Open Elective -I	3	-	-	3	40	60	100	3
6		Managerial Economics and Financial Analysis	3	-	-	3	40	60	100	3
7		Electronic Devices and Circuits Lab	-	-	2	2	40	60	100	1
8		Network Analysis Lab	-	-	2	2	40	60	100	1
9		Basic Simulation lab	-	-	2	2	40	60	100	1
Total			**18**	**-**	**6**	**24**	**360**	**540**	**900**	**21**

II B.TECH II-SEMESTER

S. No	CC	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1		Analog & Pulse Circuits	3	-	-	3	40	60	100	3
2		Analog Communications	3	-	-	3	40	60	100	3
3		Electro Magnetic Field Theory	3	-	-	3	40	60	100	3
4		Control Systems	3	-	-	3	40	60	100	3
5		Probability Theory and Stochastic Process	3	-	-	3	40	60	100	3
6		Open Elective –II	3	-	-	3	40	60	100	3
7	NC	IPR & P	2	-	-	2	40	60	100	0
8		Analog Comm. Laboratory	-	-	2	2	40	60	100	1
9		Analog & Pulse Circuits Laboratory	-	-	2	2	40	60	100	1
10		Digital Electronics and Logic Design Laboratory	-	-	2	2	40	60	100	1
Total			**20**	**-**	**6**	**26**	**400**	**600**	**1000**	**21**

B.TECH (ECE)
II-YEAR I-SEMESTER

Complex Variables & Transform Techniques

Name of the Program : B.Tech	**Academic Year :** 2019-2020
Branch: Electronics & Communication Engineering	**Year & Semester :** II B.Tech &I-Sem
Name of the Course : Complex Variables & Transform Techniques	**Regulation :** R18
Course Area/Module :	**No of students registered:**198
Course Coordinator : Mr. D.SRINIVASULU	**Course Instructors:** 1. Dr.M.Babu Prasad 2. Dr.K.KRISHNA RAO 3. Mr. D.SRINIVASULU
Designation: Professor Associate Professor	**Credits:** 3
Mail id : gktsrinu@gmail.com	**No. of Lecture Hours per week :**3 **No. of Tutorial Hours per week**: 1

Prerequisites:1.Knowledge of complex numbers, Trigonometric relations, Differentiation**,** Integration and co-ordinate Geometry
2. Convergence of series

Course Objectives:

1. To familiarize the techniques in complex variables
2. To familiarize the techniques in fourier series.
3. To familiarize the techniques in fourier transforms
4. To familiarize the techniques in Z-transforms
5. To equip the students to solve application problems in their disciplines.

Course Outcomes:	
Upon successful completion of the course, the student will be able to:	
CO1	Student will be able to ➢ **write** an analytic function if either real part or imaginary part is known and by **using** Cauchy-Riemann equations or **apply** Milne-Thompson method**(L3)**
CO2	Student will be able to ➢ **evaluate** the integral of complex function over the region bounded by the closed curves by **apply** either Cauchy-Goursat theorem or Cauchy's integral formula or Cauchy's Residue theorem**(L5)**
CO3	Students will be able to ➢ **write** the infinite series expansion of complex function by **apply** Taylor's/Maclaurin's/Laurent's series**(L3)**
CO4	Students will be able to ➢ **write** a Fourier series expansion of a periodic function by **using** Euler's formulae **(L3)**
CO5	Student will be able to ➢ **understand** the concept of Fourier transform and its properties **(L2)**
CO6	Student will be able to ➢ **solve** the difference equations using Z-transforms and Inverse Z-transforms**(L3)**

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)												
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	**3**	2	**2**	-	-	-	-	-	-	-	-
CO2	3	**3**	2	**2**	-	-	-	-	-	-	-	-
CO3	3	**3**	2	**2**	-	-	-	-	-	-	-	-
CO4	3	**3**	2	**2**	-	-	-	-	-	-	-	-
CO5	3	**3**	2	**2**	-	-	-	-	-	-	-	-
CO6	3	**3**	2	**2**	-	-	-	-	-	-	-	-

Evaluation Scheme:

Component	Duration Minutes	Marks	% Weightage
Mid Examination - I	90 Min	15	15%
Mid Examination - II	90 Min	15	15%
Online Quiz Examination - I	20 Min	10	10%
Online Quiz Examination - I	20 Min	10	10%
Assignment-I	60 Min	5	5%
Assignment-II	180 Min	70	70%
Class Test-I	90 Min	15	15%
Class test-II	90 Min	15	15%
Semester End Examination	20 Min	10	10%

Syllabus:

Unit-1: Complex Variable – Differentiation & Integration

Complex function , Real and Imaginary parts of Complex function, Limit**,** Continuity and Derivative of complex function, Cauchy-Riemann equations, Analytic function, entire function, singular point, conjugate function**,** Harmonic functions, Milne-Thomson method**.**
Line integral of a complex function, Cauchy's theorem(only statement) , Cauchy's Integral Formula.

Unit-2: Complex Variable- Series expansion, Residue Theorem & Evaluation of Real Integrals

Absolutely convergent and uniformly convergent of series of complex terms, Radius of convergence**,** Taylor's series, Maclaurin's series expansion, Laurent's series.

Zeros of an analytic function, Singularity, Isolated singularity, Removable singularity, Essential singularity, pole of order m, simple pole, Residues, Residue theorem, Calculation of residues, Residue at a pole of order m**,**
Evaluation of real definite integrals: Integration around the unit circle**,** Integration around semi circle.

Unit-3: Fourier Series and Transforms

Introduction, Eulers formula, conditions for Fourier expansion**,** Functions having points of discontinuity, change of interval, Odd and Even function-expansions, Half-range series**.**
Fourier integral theorem (without proof) – Fourier sine and cosine integrals - sine and cosine transforms – properties, Inverse transforms – Finite Fourier transforms.

Unit-4: Z-Transforms .

Definition of Z-transform, elementary properties, linearity property, damping rule, shifting u_n to the right and left, multiplication by n, initial value theorem, final value theorem, Inverse Z-transform, convolution theorem, formation of difference equations, solution of difference equations using Z-transforms

TEXT BOOKS:
1.B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43/e, 2010.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9/e, John Wiley & Sons, 2006.

REFERENCE BOOKS:
1. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7/e, Mc-Graw Hill, 2004.
2.N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, 2008.

E-RESOURCES:
1.www.nptelvideos.com/mathematics/ (Math Lectures from MIT,Stanford,IIT'S)
2.nptel.ac.in/courses/122104017
3.nptel.ac.in/courses/111105035

Network Analysis And Transmission Lines

Name of the Program : B.Tech	**Academic Year :** 2019-2020
Branch: Electronics & Communication Engineering	**Year & Semester :** II B.Tech &I-Sem
Name of the Course : Network Analysis and Transmission Lines	**Regulation :** R18
Course Area/Module : Microwaves and Antennas	**No of students registered:**198
Course Coordinator : N Swarnalatha N Malathi	**Course Instructors:**
Designation: Associate Professor	**Credits:** 3
Contact Details : **Mail id :hairehman@gmail.com**	**No. of Lecture Hours per week :**4 **No. of Tutorial Hours per week**: 1

Pre-Requisites for the Course:

Students are assumed to have back ground knowledge on the following topics:

1. Properties of conductors and Dielectrics.

Pre-requisite Courses:

Applied Physics.

Course Description:

Students will be introduced to EM waves , principle of operation, the different types of waveEquations and mechanism analysis and their applications. The course provides introduce the student to expose students to examples of applications and various Transmissionline types also wave propagation.

Course Objectives:

Students will be able To

1.	To know the behaviour of the steady state and transient states in RLC circuits
2.	To understand the resonance and two port network parameters
3.	Wave characteristics in different media for normal and oblique incidence.
4.	Various concepts of transmission lines and impedance measurements

Course Outcomes:

Course Name: NATL	
Upon successful completion of this course, students should be able to	
C222.1	Gain the knowledge on basic RLC circuits behavior.
C222.2	Analyze the steady state and transient states of RLC circuits.
C222.3	Analyze the two port network parameters.
C222.4	Demonstrate the reflection and Refraction of EM waves at boundaries
C222.5	Analyse basic transmission line parameters.
C222.6	Analysis and Design of a transmission lines.

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
CO1	3	3	3							3		2
CO2	3	3	3							3		2
CO3	3	3	2							3		2
CO4	3	3	2							3		2
CO5	3	3	2							3		2
CO6	3	3	2							3		2
Total	18	18	14							18		10
Avg.	3	3	2.33							3		1.6

Course Content (Syllabus):

UNIT I

Network Theorems

Super position theorem, Thevenin's theorem, Norton's theorem, and Maximum Power Transfer theorem.

Two Port Network

Relationship of two port variables, Short circuit admittance parameters, Open circuit impedance parameters, Transmission parameters, Hybrid parameters, Relation between parameter sets.

UNIT II

Transient and Steady state analysis of RC, RL and RLC Circuits

Response to sinusoidal excitation—series RL, RC and RLC Circuits, parallel RC, RL and RLC.

Resonance

Introduction, Definition of Q series resonance, Bandwidth of series resonance, parallel resonance, Condition for maximum impedance, current in anti resonance, Bandwidth of parallel resonance.

UNIT III

Transmission Lines - I

Types, Parameters, Transmission Line Equations, Primary & Secondary Constants, Equivalent Circuit, Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Infinite Line Concepts

Part II

Lossless / Low Loss Characterization, Types of Distortion, Condition for Distortion less line, Minimum Attenuation, Loading - Types of Loading.

UNIT IV

Transmission Lines – II

Input Impedance Relations, SC and OC Lines, Reflection Coefficient, VSWR. Low loss radio frequency lines and UHF Transmission lines, UHF Lines as Circuit Elements

Part II

λ/4, λ/2, λ/8 Lines – Impedance Transformations, Smith Chart – Configuration and Applications, Single Stub Matching.

Pre-Requisites for the Course:

Mathematics I & Mathematics II

Course Objectives:

1. To understand the basic concepts on RLC circuits
2. To know the behavior of the steady states and transient states in RLC circuits
3. To understand the two port network parameters
4. Various concepts of transmission lines and impedance measurements

Digital Electronics and Logic Design

Name of the Program: B.Tech	**Academic Year:** 2019-20
Branch: ECE	**Year & Semester:** II/I
Name of the Course: Digital Electronics and Logic Design	**Regulation:** R18
Course Area/Module: Digital Electronics	**No. of students registered:** 198
Course Coordinator: M.Mahesh **Designation:** Assistant Professor	**Course Instructors:** 1. M. Mahesh 2. K. Prathyusha
No. of Lecture Hours per week:	**No. of Tutorial Hours per week:** 4
Credits:3	

Course Objectives:

Students will be able to:

1. To study the basic philosophy underlying the various number systems, negative number representation, binary arithmetic, binary codes and error detecting and correcting binary code.
2. To study the theory of Boolean algebra and to study representation of switching functions using Boolean expressions and their minimization techniques.
3. To study the combinational logic design of various logic and switching devices and their realization.
4. To study some of the programmable logic devices and their use in realization of switching functions.
5. To study the sequential logic circuits design both in synchronous and Asynchronous modes for various complex logic and switching devices, their minimization techniques and their realizations.
6. To implement synchronous state machines using flip flops.

Course Outcomes:

At the end of the course, the students will develop ability to:

1. Understand the numeric information in different forms and interpret different logic gates.
2. Minimize the given Switching functions in SoP and PoS forms using K-Map and Tabular Method.
3. Analyze and Design various combinational circuits like Encoders, Decoders, Multiplexers, De-multiplexers, and Arithmetic Circuits.
4. Design combinational logic circuits using different types of Programmable Logic Designs.
5. Design and Implement various sequential circuits like flip flops, registers.
6. Design the state diagrams with the knowledge of Mealy and Moore conversions, state machines using various flip flops.

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
CO1	3	3	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	2	-	3
CO4	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	2	-	3
CO6	2	2	3	-	-	-	-	-	-	-	-	-
Total	16	12	6	-	-	-	-	-	-	4	-	6
Avg.	**2.67**	**2.00**	**1.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.67**	**0.00**	**1.00**

Pre-Requisites for the Course:

Students are expected to have knowledge on the following topics:

S. No	Topic
1	Set theory (Mathematics)
2	Basic logic operations like bit wise operations, Shift operations, flow charts, ASCII codes, etc. (Computer Programming)
3	Number systems, Digital logic design, Concepts of state machines using flip flops.

Course Description:

This Course provides in-depth knowledge of Digital Logic and design techniques of digital circuits and fundamental concepts used in the design of digital systems. Describe the common forms of number representation in digital electronic circuits and to be able to convert between different representations. Discuss the combinational circuit's using simple logical operations. Design combinational logic circuits & sequential logic circuits. This subject is required to understand the later subjects like LDICA, MPMC, VLSI& ES, etc. By studying this subject, the students can design and understand digital systems and its importance. The students logical thinking capability will be improved which will help in placements and in their future technical assignments.

Course Content (Syllabus):

UNIT- I

Number Systems and Binary Codes

Philosophy of number systems, complement representation of negative numbers, binary arithmetic, binary codes, error detecting & error correcting codes – Hamming codes.

Boolean algebra

Fundamental postulates of Boolean algebra, Basic theorems and properties. Digital logic gates, Representation of Boolean Functions using Canonical and Standard forms, , Multilevel NAND/NOR realizations.

UNIT- II

Minimization of Switching Functions

Minimization of switching functions using K-Map up to 5-variables, Tabulation Method.

Combinational Circuits

Design of Adders, Subtractors, Parallel Binary Adder, BCD adder, Encoder, Decoder, Multiplexer (MUX), Demultiplexer, Parity generator, Magnitude Comparator, Code converters.

UNIT- III

Programmable Logic Devices

Basic Structures of PROM, PLA, PAL, Realization of switching functions using PROM, PLA and PAL.

Sequential Logic Circuits-I

Classification of sequential circuits, Basic flip-flops (Truth tables and excitation tables), MS JK flip-flop, Race Around Condition, Conversion from one flip-flop to another flip-flop.

UNIT- IV

Sequential Logic Circuits II

Design of ripple counters, Design of synchronous counters, Registers, Shift register, Bidirectional Shift register, Universal shift register.

Synchronous Sequential Machines

State reduction and State assignment, Partitioning method, Mealy and Moore models, Design procedures, Design and realization of circuits using various Flip-flops.

Text Books:

1. Switching Theory & Logic Design by A. Anand Kumar,PHI,3rd Edition.
2. Digital Design, Morris Mano, PHI, 3rd Edition, 2001.
3. Switching and Finite Automata theory, Zvi Kohavi and Niraj k Jha, Cambridge University Press, 3rd edition, 2010.

References:

1. Fundamentals of Logic Design, Charles H. Roth, Thomson Publications, 5th Edition, 2009.
2. Modern Digital Electronics by R.P. Jain, Mcgraw Hill, 3rd edition.

Signals and Systems

Name of the Program: B.Tech	**Academic Year:** 2019-2020
Branch: ECE	**Year & Semester:** II & I
Name of the Course: Signals and Systems	**Regulation:** Autonomous
Course Area/Module:	**No. of students registered:** 198
Course Coordinator: V.Srinivasa Rao **Designation:** Associate Professor	**Course Instructors:** P.L.Amrutha Valli
No. of Lecture Hours per week: 5	**No. of Tutorial Hours per week:**
Credits: 3	

Course objectives:

Students will be able to:

1. To introduce the terminology of signals and systems and Fourier tools through the analogy between vectors and signals
2. To introduce Fourier transform to convert signal from time domain to frequency domain and understand the concept of sampling and reconstruction of signals
3. To analyze the linear systems in time and frequency domains and understand importance of convolution, correlation.
4. To study Laplace-transform as mathematical tool to convert signals from time domain to complex frequency domain, and also study Z-transform as mathematical tool to analyze discrete-time signals and systems.

Course outcomes:

At the end of the course, the students will develop ability to:

1. Learn the basic concepts of signals and systems and represent signal in terms of Exponential and Trigonometric Fourier Series.
2. Transform the time domain signal into frequency domain by applying Fourier Transform.
3. Perform sampling and reconstruction of signals with the help of Nyquist criterion.
4. Analyze Linear systems in time and frequency domain and understand the properties of convolution and correlation.
5. Transform continuous time signals into complex frequency domain by applying Laplace Transforms.
6. Transform discrete time signals into complex frequency domain by applying Z – Transforms.

Pre-Requisites for the Course:

Students are expected to have knowledge on the following topics:

S. No	Topic
1	Engineering Mathematics –I
2	Engineering Mathematics –II

CO-PO Mapping:

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
CO1	3	3	2	2					2		1	
CO2	3	2	2	1	3						2	
CO3	3	3	2	2	2	1					2	
CO4	3	3		2	3					2		2
CO5	3	3		2	3					2		2
CO6	18	16	6	10	11	1	-	-	2	4	6	5
Total	3	2.66	2	1.66	2.75	1	-	-	2	2.66	1.5	1.66
Avg.	3	3	2	2					2		1	

Course Content (Syllabus):

UNIT I

Introduction To Signals And Systems

Continuous and discrete time signals, Exponential and sinusoidal signals, Concepts of Impulse function, Unit step function and Signum function. Continuous and discrete time systems, Basic system properties. Orthogonal signal space and Signal approximation using orthogonal functions.

Fourier Series

Representation of Fourier series, Continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Complex Fourier spectrum.

UNIT II

Fourier Transforms

Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function.

Sampling

Sampling theorem, Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling, Aliasing.

UNIT III

Linear System Analysis

Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics.

Convolution and Correlation of Signals

Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution property of Fourier transforms. Cross correlation and auto correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and energy/power spectral density function. Relation between convolution and correlation.

UNIT IV
Laplace Transforms

Review of Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.Ts, Relation between L.T and F.T. of a signal.

Z-Transforms

Fundamental difference between continuous and discrete time signals, discrete time signal representation using complex exponential and sinusoidal components, Periodicity of discrete time using complex exponential signal, Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform,
properties of Z-transforms

Text Books:

1. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn
2. Signals & Systems- A.Anand Kumar – 2nd Edition, PHI, 2012.
3. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.

References:

1. Signals & Systems - Simon Haykin and Van Veen,Wiley, 2nd Edition.
2. Signals and Systems - K R RajeswariB.VisvesvaraRao, "Signals & Systems" –1st Edition, PHI, 2009.
3. Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition, 2008.
4. Charles L.Phillips, John M. Parr, Eve A. Riskin, "Signals, Systems, and Transforms", Pearson Publications, 4th Edition.

Data Structure and Algorithms

Name of the Program: UG(B.Tech)	**Academic Year:** 2019 - 2020
Branch: ECE	**Year & Semester:** II /I
Name of the Course: Data Structures	**Regulation:** NRIA18
Course Area/Module: Data Structure and Algorithms	**No. of students registered:** 180
Course Coordinator: SK.Mahaboob Basha Designation: Associate Professor	**Course Instructors:** **1.** Mr.Seetharam **2.** Mr.B. Avinash
No. of Lecture Hours per week:3	**No. of Tutorial Hours per week:** 1
Credits:3	

Course Objectives:

Students will be able to:

1. To impart basic knowledge of data structures.
2. Be familiar with basic techniques of algorithm analysis
3. Be familiar with writing recursive methods
4. To understand concepts about searching and sorting techniques
5. To understand concepts about searching and sorting techniques
6. To design and implementation of various basic and advanced data structures like stacks, queues, lists, trees and graphs.
7. To design and implementation of various basic and advanced data structures like stacks, queues, lists, trees and graphs.
8. To introduce various techniques for representation of the data in the real world.
9. To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures

Course Outcomes:

At the end of the course, the students will develop ability to:

1. Ability to analyze algorithms, and to understand the concept of recursive function
2. Ability to summarize searching and sorting techniques.
3. Ability to describe linked list operations
4. Ability to describe stack, queue and linked list operation
5. Ability to have knowledge of Trees, able to use trees to solve real time problems
6. to apply concepts of graphs to solve real time problems

CO-PO Mapping:

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
CO1	3	3	2	2								2
CO2	3	2	3	2								2

CO3	3	2	3	2								2
CO4	3	2	3	2								2
CO5	3	2	3	2								2
CO6	3	2	3	2								2
Total	18	13	17	12								12
Avg.	3	2.7	3	2								2

Pre-Requisites for the Course:
C Programming

Students are expected to have knowledge on the following topics:

S.No	Topic
1	Data Structures, Recursion, Searching and Sorting.
2	Linked Lists, Stacks, and Queues.
3	Trees.
4	Graphs

Course Description:

In computer science, a data structure is a data organization, management, and storage format that enable efficient access and modification. More precisely, a data structure is a collection of data values, the relationships among them, and the functions or operations that can be applied to the data.

Course Content (Syllabus):

UNIT I
Data Structures, Recursion, Searching and Sorting

Data Structures: Definition, Types of Data Structures, Arrays, structures, self-referential structures, Operations, Algorithm analysis Time Complexity and Space Complexity.
Recursion: Definition, Linear and Binary recursions, Iteration vs. Recursion.
Searching: Linear Search, Binary Search.
Sorting: Basic concepts, Divide-and-Conquer approach, Insertion Sort, Merge Sort, Quick Sort, and Heap Sort.

UNIT II
Linked Lists, Stacks, and Queues.

Linked Lists: Introduction, types of Linked Lists, operations, inserting a node in Single Linked List, deleting a node in Single Linked List, searching a node in Single Linked List, inserting, deleting, and searching a node in Double Linked List.
Stacks: Introduction, operations, applications, Stacks implementation using Arrays, Stacks implementation using Linked List, Expression Conversion: Infix to Postfix, Infix to Prefix.
Queues: Introduction, operations, applications, Queues implementation using Arrays, Queues implementation using Linked Lists, Circular Queue. Priority Queues

UNIT III
Trees

Basic Tree Concepts, Terminology, operations, Tree traversals, **Binary Trees:** definition,

properties, Binary Tree representations, operations, **Binary Search Tree:** definition, properties, applications, Inserting, Deleting, and Searching element in Binary Search Tree,
Threaded Binary Tree: definition, properties, Inserting a Node into a Threaded Binary Tree, **Heaps:** Definition of a Max Heap, properties.

UNIT IV
Graphs

Introduction, Terminology, Representation of graphs, types of graphs, applications, operations, Graph transversal techniques: Breadth First Search (BFS), Depth First Search (DFS), implementations. **Minimum Spanning Tree (MST):** definition, Prim's algorithm, Kruskal's algorithm, **Shortest paths:** Basic Concepts, Dijsktra's algorithm.

Text books:

1 Data Structures using C,ReemaThareja, Oxford
2 Fundamentals of DATA STRUCTURES in C, Horowitz,SartajSahani, Susan Anderson – Freed, University Press

Reference Books:

1 Data Structures using C, 2nd Edition,by A. K. Sharma, Pearson India
2. Classic Data Structures, 2/e, Debasis, Samanta, PHI,2009
3 Data Structures and Algorithms, 2008, G.A.V.Pai, TMH
4 Data Structures, 2/e, Richard F, Gilberg , Forouzan, Cengage
5 DATA STRUCTURE USING C,Udit Agarwal,KATSON Books

E-Resources:

1. https://en.wikipedia.org/wiki/Data_structure
2. https://www.tutorialspoint.com/data_structures_algorithms/data_structures_basics

3. http://nptel.ac.in/courses/106103069/

Managerial Economics and Financial Accounts

Name of the Program: UG(B.Tech)	**Academic Year:** 2019 - 2020
Branch: ECE	**Year &Semester**: II /I
Name of the Course: MEFA	**Regulation:** NRIA18
Course Area/Module: MANAGEMENT	**No. of students registered:** 180
Course Coordinator: 1.Dr.D.kailasa Rao 2.Designation: PROFESSOR	**Course Instructors:** 3.Dr.D.kailasa Rao 4.Mr. D.N Rajesh
No. of Lecture Hours per week:3	**No. of Tutorial Hours per week**:0
Credits:3	

Course Objectives:

Students will be able to:

1. To enhance the knowledge of the students regarding importance of management and Managerial problems with optimum solutions and Demand Forecasting-methods.
2. To develop the concepts viz., Consumer Behavior and demand concept.
3. To provide the knowledge regarding production and cost and Break-Even Analysis.
4. To share the concepts like market structures and Business Organization.
5. To provide awareness regarding Capital Budgeting decisions & give an idea of practicing technique of Ratio Analysis.
6. To introduce the concepts- Financial Accounting.

Course Outcomes:

At the end of the course, the students will develop ability to:

1 Use the theory of managerial Economics ,demand ,Production analysis and fore casting theories.
2 Analyze of production markets and pricing strategies .Functions and Cost-price functions to manage markets & Break-Even point.
3 Develop an ability to identify, formulate and solve Engineering problem by applying the knowledge of Managerial Economics.
4 Theorize about characteristics features and types of Industrial organization, concept of changing business environment in Post-Liberalization scenario.
5 Enhance their capabilities in the interpretation of b/s that are followed in industries, organizations and institutes.
6 Apply financial analysis ,capital budgeting techniques in Evaluating various investment opportunities

CO-PO Mapping:

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
CO1	1											
CO2		1										
CO3	2	2	1									
CO4			1				1					
CO5	1		1			2						
CO6	1				1						1	
Total	6	3	3		1	2	1				1	
Avg.	1.5	1.5	1		1	2	1				1	

Pre-Requisites for the Course:

Nil

Course Description: This course covers micro Economic issues relating to demand and supply, types of markets and their price determination and pricing. Along with that students should have to develop a basic understanding of what financial statements contains and how to use them to assess a company's profitability and financial position. This course introduces various concepts of Economics and accounting that will be helpful in right decision making.

Course Content (Syllabus):

UNIT I
Introduction to Managerial Economics and Demand Analysis

Nature & Scope of Managerial Economics & its relationship with other subjects
Concept of Demand, Determinants of Demand-law of demand & its limitations
Elasticity of demand Types and measurements –Demand forecasting and methods.

UNIT II
Cost Analysis & Introduction to Markets

Different cost concepts :opportunity costs, Explicit & Implicit costs, Fixed & Variable costs Average & Marginal ,Short run & Long run costs Break Even Analysis(Simple problems). market-nature and types-monopolistic competition and oligopoly.

UNIT III
Types of Business Organisation & Business cycles

Features and Evaluation of sole Trader,Partnership ,Joint stock company & co-operative Societies.
Business Cycles: Meaning & features of Business cycles –Phases & control of Business cycles-concept of money and money supply, Functions of Commercial banks and RBI credit control methods of RBI.

UNIT IV

Introduction to Accounting and Financial Analysis

Introduction to Double entry system ,Journal, Ledger ,Trial balance & Final accounts.

Financial Analysis

Ratio Analysis-Need & significance(simple problems)Capital Budgeting Meaning & importance – Methods of Capital Budgeting :Payback period ,ARR(Accounting Rate Of Return),NPV(Net Present Value)(simple problems).

Text Books:

1. Dr.A.R.Aryasri-Managerial Economics and Financial Analysis TMH 2011.
2.Dr.N.Appa Rao, Dr.p.vijay kumar :Managerial Economics and Financial Analysis carigage publications ,New Delhi-2011.
3.Prof.J.V.Prabhakara Rao,Prof.P.Venkata Rao.Managerial Economics and Financial Analysis-Ravindra publications.

Reference Books:

1.V.Maheswari Managerial Economics Sultan Chand.2014.
2.Dr.B.Kuberudu and Dr.T.v.Ramana:managerial economics and Financial Analysis,Himalaya publishing House,2014.
3.Suma Damodaran:Managerial Economics,Oxford,2011.
4.Maheswari:Financial Accounting ,Vikas Publications.
5.Shailaja,Gajjala and Usha Munipalle,Universities press,2015
6. Banking Law and Practise , Gordan and Mithani, Himalaya publications

E-Resources:

1.https://www.tutorialspoint.com/managerialeconomic

2.https://lecturenotes.in/subject/566/managerial-economics-and-financial-analysis-mefa

Electronic Devices and Circuits Laboratory

LIST OF EXPERIMENTS

PART-I

1. Resistors: Colour Codes, Variable Resistors and LDR
2. Capacitors and their Colour codes
3. Coils and Inductors
4. Relays and switches
5. Breadboards
6. Diodes
7. Transistors BJT, UJT, FET
8. Silicon Controlled Rectifiers SCR
9. Soldering Guide
10. Multimeters, CRO
11. Function Generator, Regulated Power Supply

PART-II

1. PN Junction Diode Characteristics
    a. Silicon Diode Characteristics
    b. Germanium Diode Characteristics
2. Zener diode characteristics and
   Zener as Voltage Regulator
3. Rectifiers
   Half Wave Rectifier with and without filters
4. Rectifiers
   Full Wave Rectifier with and without filters
5. Transistor CE Characteristics
    a. Input Characteristics
    b. Output Characteristics
6. Transistor CB Characteristics
    a. Input Characteristics
    b. Output Characteristics
7. FET Characteristics
    a. Drain Characteristics
    b. Transfer characteristics
8. CRO Operation and its measurements
9. UJT Characteristics
10. UJT Relaxation Oscillator
11. SCR Characteristics
12. Transistor Biasing
13. LED Characteristics

Network Analysis Laboratory

Preamble:

The objective of the Network Analysis lab is to expose the students to the of electrical circuits and give them experimental skill. The purpose of lab experiment is to continue to build circuit construction skills using different circuit element. It also aims to introduce MATLAB a circuit simulation software tool. It enables the students to gain sufficient knowledge on the programming and simulation of Electrical circuits.

Course Outcomes: Upon the completion of Network Analysis practical course, the student will be able to attain the following:

- Familiarity with DC and AC circuit analysis techniques.
- Analyze complicated circuits using different network theorems.
- Acquire skills of using MATLAB software for electrical circuit studies.
- Acquire skills of two port network parameters (Z, Y, ABCD, h & g).
- Determine the self and mutual inductance of coupled coils.

S.No	List of Experiments
1	Verification of Kirchhoff's current law and voltage law using hard ware and digital simulation.
2	Verification of mesh analysis using hard ware and digital simulation.
3	Verification of nodal analysis using hard ware and digital simulation.
4	Verification of super position theorem using hard ware and digitalsimulation.
5	Verification of reciprocity theorem using hardware and digital simulation.
6	Verification of maximum power transfer theorem using hardware anddigital simulation.
7	Verification of Thevenin's theorem using hard ware and digital simulation.
8	Verification of Norton's theorem using hard ware and digital simulation.
9	Verification of compensation theorem using hard ware and digitalsimulation.
10	Verification of series resonance using hard ware and digital simulation.
11	Verification of parallel resonance using hard ware and digital simulation.
12	Verification of Two Port Network Parameters Z & Y Parameters using hard ware
13	Verification of Two Port Network Parameters ABCD & HYBRID Parameters using hard ware.
14	Verification of self inductance and mutual inductance by using hard ware.

Basic Simulation Laboratory

List of Experiments

- All the experiments are to be simulated using MATLAB or equivalent software.
- Minimum of 10 experiments are to be completed.

1. Basic Operations on Matrices.
2. Generation of Various Signals and Sequences (Periodic And Aperiodic), Such as Unit Impulse, Unit Step, Square, Saw Tooth, Triangular, Sinusoidal, Ramp, Sinc.
3. Operations on Signals And Sequences Such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy And Average Power.
4. Finding the Even and Odd Parts of Signal/ Sequence and Real and Imaginary Parts of Signal.
5. Convolution between Signals and Sequences.
6. Autocorrelation and Cross Correlation between Signals and Sequences.
7. Verification of Linearity and Time Invariance Properties of a given Continuous/Discrete System.
8. Computation of Unit Sample, Unit Step And Sinusoidal Responses Of The Given LTI System And Verifying Its Physical Realizability and Stability Properties.
9. Finding the Fourier Transform of a Given Signal and Plotting Its Magnitude and Phase Spectrum.
10. Waveform Synthesis Using Laplace Transforms.
11. Locating the Zeros and Poles And Plotting the Pole-Zero Maps in S Plane and Z-Plane For the given Transfer Function.
12. Sampling Theorem Verification.

B.TECH (ECE)
II-YEAR II-SEMESTER

Analog and Pulse Circuits

Name of the Program: B.TECH	**Academic Year: 2019 – 2020**
Branch: ECE	**Year & Semester: II & II**
Name of the Course: ANALOG AND PULSE CIRCUITS	**Regulation: NRIA18**
Course Area/Module: Analog Electronics	**No. of students registered: 198**
Course Coordinator: R.Sunitha Designation: Professor	**Course Instructors: 1. D. Ravisankar 2. R.Sunitha**
No. of Lecture Hours per week: 3	**No. of Tutorial Hours per week: 0**
Credits: 3	

Course Objectives:

Students will be able to:

1.To demonstrate BJT amplifier using h parameters
2. To explain feedback amplifiers and oscillators
3. To know the classification of the power amplifiers and their analysis
4. To study and design the concepts of linear and non linear wave shaping circuits
5. To analyze different types of Multi vibrators and their design procedures
6. To understand the basic principles of Sampling gates

Course Outcomes:

At the end of the course, the students will develop ability to:

1. To explain BJT amplifier using h parameter model
2. To analyze and design electronic subsystems such as feedback amplifiers and oscillators
3. To analyze power amplifiers such as Class A and Class B and compare their performance
4. To design linear and non linear wave shaping circuits with different inputs
5. To deign and analyze various multi vibrators using transistors
6. To remember and analyze unidirectional and bidirectional sampling gates

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	2	3			2							
CO3			3		2							
CO4	3		3									
CO5	3		3									
CO6			3									
Total	11	3	12	---	4	---	---	---	---	---	---	---
Avg.	2.75	3	3	0	2	0	0	0	0	0	0	0

Pre-Requisites for the Course:

Students are expected to have knowledge on the following topics:

S. No	Topic
1	Engineering Mathematics
2	Network Analysis
3	Electronic devices and circuits

Course Description:

This course starts by introducing some basic ideas of electronic amplifiers and study of feedback concepts (both positive and negative). Subsequently the course probes into introduction and emphasis of oscillators. Further design concepts of power amplifiers are also explained. This course covers pulse waveforms, linear and non linear circuits and their responses due to sinusoidal and non sinusoidal inputs. This course helps in understanding various types of multivibrators and their design procedures. This course gives an overview of unidirectional and bidirectional sampling gates and applications of sampling gates

Evaluation Scheme:

Component	Duration Minutes	Marks	% Weightage
Mid Examination - I	90 Min	15	15%
Mid Examination - II	90 Min	15	15%
Online Quiz Examination - I	20 Min	10	10%
Online Quiz Examination - I	20 Min	10	10%
Assignment-I	60 Min	5	5%
Assignment-II	180 Min	70	70%
Class Test-I	90 Min	15	15%
Class test-II	90 Min	15	15%
Semester End Examination	20 Min	10	10%

Course Content (Syllabus):

UNIT I
AMPLIFIERS

Classification of amplifiers, Two port network, Determination of h parameters, Transistor hybrid model, Generalized analysis of transistor amplifier in CB, CE and CC configurations using h-parameters, Comparison of transistor amplifiers.

FEEDBACK AMPLIFIERS

Feedback principle and concept, types of feedback, feedback topologies, Characteristics of negative feedback amplifiers, Generalized analysis of feedback amplifiers, Performance comparison of feedback amplifiers, Illustrative Problems

UNIT II
OSCILLATORS

Oscillator principle, condition for oscillations, RC-phase shift and Wein bridge oscillators and their analysis, Generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators, Illustrative Problems

POWER AMPLIFIERS

Overview of power amplifiers, Class A power Amplifiers and their analysis, Class B Push-pull amplifiers and their analysis, Illustrative Problems

UNIT III
LINEAR WAVE SHAPING

High pass, Low pass RC circuits, their response expressions for sinusoidal, step, pulse, square, ramp and exponential inputs (Qualitative Treatment Only)

NON LINEAR WAVE SHAPING

Diode clippers, Transistor clippers, clipping at two independent levels, Emitter coupled clipper; Clamping operation, Clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage (Qualitative Treatment Only)

UNIT IV
MULTIVIBRATORS

Bistable Multi Vibrator – Analysis and Design of Fixed Bias Bistable Multi Vibrator, Schmitt trigger, **Monostable Multi Vibrator –** Analysis and Design of Collector Coupled Monostable Multi Vibrator, **Astable Multi Vibrator –** Analysis and Design of Collector Coupled Astable Multi vibrator (Qualitative Treatment Only)

SAMPLING GATES

Basic operating principles of sampling gates, unidirectional sampling gate, unidirectional sampling gates to accommodate more than one input signal, bidirectional sampling gates using transistors, reduction of pedestal in a gate circuit, bidirectional sampling gates, four diode sampling gate, six diode sampling gates, applications of sampling gates

TEXT BOOKS

- Electronic Devices and Circuits- Salivahanan, N.Suressh Kumar, A. Vallavaraj, TATA McGraw Hill, Second Edition. **(UNITS I, II)**
- Pulse and Digital Circuits – A. Anand Kumar, PHI, 2005 **(UNIT III,IV)**
- Integrated Electronics- J. Millman and C.C. Halkias, Tata Mc Graw-Hill, 1972

REFERENCES

- Electronic Circuit Analysis and Design – Donald A. Neaman, Mc Graw Hill.
- Electronic Devices and Circuits Theory – Robert L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, Tenth Edition.
- Electronic Circuit Analysis – A.P.Godse, Technical Publications
- Pulse and Digital Circuits – B.Yoganarsimhan
- Pulse & Digital Circuits by Venkata Rao,K,Ramasudha K, Manmadha Rao,G., Pearson,2010
- Pulse, Digital and Switching Waveforms - J. Millman and H. Taub, McGraw-Hill, 1991

Analog Communications

MappName of the Program: B.Tech	**Academic Year:** 2019 – 20
Branch: E.C. E	**Year & Semester:** II - II
Name of the Course: Analog Communications	**Regulation: NRIA18**
Course Area/Module: Communication Systems	**No. of students registered: 198**
Course Coordinator: M.S.S.S Srinivas **Designation:** Associate Professor	**Course Instructors:** **3.** M.S.S.S. Srinivas **4.** M. Mahesh
No. of Lecture Hours per week: 5	**No. of Tutorial Hours per week:**
Credits: 3	

Course objectives:

Students will be able to:

1. The fundamentals of basic communication system Need of modulation, modulation processes and different amplitude modulation schemes.
2. Different angle modulation schemes with generation and detection methods.
3. Understand types of Noises & Generation and detection of pulse modulation techniques and multiplexing
4. Remember various radio receivers with their parameters.

Course outcomes:

At the end of the course, the students will develop ability to:

1. Understand different blocks in communication system & Design of various modulation and demodulation techniques.
2. Analyze generation and detection of FM signal & comparison between amplitude and angle modulation schemes.
3. Understand the types of noise affecting communication system and noise parameters. & Design generation & detection of Pulse Modulation techniques.
4. Identify different types of transmitters and receivers circuits and role of AGC

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2			1							2
CO2	3	2			1							2
CO3	3	2			1							2
CO4	3	2										2
Total	12	8			3							8
Avg.	3	2			0.75							2

Pre-requisites for the course:

Students are expected to have knowledge on the following topics:

S. No	Topic
1	Signals & Systems

Course Description:

Almost every day we are aware, or make use, of concepts such as electronic mail, wired cities, overnight stock market quotes fed into our home computers, tele conferencing, and a host of space and military applications of electronic communication. This subject is concerned with the theory of systems for the conveyance of information. The transmission of information-bearing signal over a band pass communication channel, such as telephone line or a satellite channel usually requires a shift of the range of frequencies contained in the signal to another frequency range suitable for transmission. A shift in the signal frequency range is accomplished by modulation. This chapter introduces the definition of modulation, need of modulation, types of modulation- AM, PM and FM, Various types of AM, spectra of AM, bandwidth requirements, Generation of AM & DSB-SC, detection of AM & DSB-SC, and power relations.

Course Content (Syllabus):

UNIT I

AMPLITUDE MODULATION : Introduction to communication system, Need for modulation, Frequency Division Multiplexing , Amplitude Modulation, Definition, Time domain and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves, Detection of AM Waves

DSB & SSB MODULATION: Generation of DSBSC Waves, Coherent detection of DSB-SC Modulated waves, COSTAS Loop. Frequency domain description, Frequency discrimination method for generation of AM SSB Modulated Wave, Phase discrimination method for generating AM SSB Modulated waves. Demodulation of SSB Waves.

UNIT II

VESTIGIAL SIDE BAND MODULATION: Frequency description, Generation of VSB Modulated wave, Time domain description, Envelope detection of a VSB Wave pulse Carrier, Comparison of AM Techniques.

ANGLE MODULATION: Basic concepts, Frequency Modulation,Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, Direct FM, Detection of FM Waves: Balanced Frequency discriminator, Zero crossing detector, Phase locked loop, Comparison of FM & AM.

UNIT III

NOISE: Noise in Analog communication System, Noise in DSB & SSB System, Noise in AM System, Noise in Angle Modulation System, Threshold effect in Angle Modulation System, Pre-emphasis & de-emphasis.

PULSE MODULATION: Time Division Multiplexing, Types of Pulse modulation, PAM (Single polarity, double polarity) PWM: Generation & demodulation of PWM, PPM, Generation and demodulation of PPM, TDM Vs FDM.

UNIT IV

TRANSMITTERS & RECEIVERS:

Radio Transmitter – Classification of Transmitter, AM Transmitter, FM Transmitter – Variable reactance type and phase modulated FM Transmitter, frequency stability in FM Transmitter.

Radio Receiver -Receiver Types - Tuned radio frequency receiver, Superhetrodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver, Comparison with AM Receiver, Amplitude limiting.

TEXT BOOKS:

1. Principles of Communication Systems - Simon Haykin, John Wiley,2nd Ed.
2. Communication Systems – B.P. Lathi, BS Publication, 2006.

REFERENCES:

1. Principles of Communication Systems – H Taub & D. Schilling, Gautam Sahe, TMH, 2007 3rd Edition.
2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004.
3. Communication Systems– R.P. Singh, SP Sapre, Second Edition TMH, 2007.
4. Fundamentals of Communication Systems - John G. Proakis, Masond, Salehi PEA, 2006.

Electro Magnetic Field Theory

Name of the Program: B.Tech	**Academic Year: 2019-2020**
Branch: ECE	**Year & Semester: II-II**
Name of the Course: Electromagnetic Field Theory	**Regulation: NRIA18**
Course Area/Module: Antennas and EM Waves	**No. of students registered : 198**
Course Coordinator: Dr.P Rama Koteswara Rao **Designation:** Professor	**Course Instructors:** **1.** Dr P Rama Koteswara Rao **2.** N Malathi
No. of Lecture Hours per week: 03	**No. of Tutorial Hours per week:00**
Credits:03	

Course Objectives:

Students will be able to:

1. To study the basic philosophy underlying the various number systems, negative number representation, binary arithmetic, binary codes and error detecting and correcting binary code.
2. To study the theory of Boolean algebra and to study representation of switching functions using Boolean expressions and their minimization techniques.
3. To study the combinational logic design of various logic and switching devices and their realization.
4. To study some of the programmable logic devices and their use in realization of switching functions.
5. To study the sequential logic circuits design both in synchronous and Asynchronous modes for various complex logic and switching devices, their minimization techniques and their realizations.
6. To implement synchronous state machines using flip flops.

Course Outcomes:

At the end of the course, the students will be able to:

C224.1	Interpret and Apply the static electrostatic fields with respect to coordinate systems.
C224.2	Analyze and Demonstrate the static magnetic fields in real time applications.
C224.3	Formulate the Maxwell's Equations in different forms.
C224.4	Associate the fundamental theory of electromagnetic waves in free space and their practical applications.
C224.5	Evaluate and Relate wave propagation characteristics in different conducting media.
C224.6	Demonstrate the reflection and Refraction of EM waves in normal and oblique incidences

Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
C224.1	3		2									
C224.2		3										
C224.3			3									3
C224.4	3				2							
C224.5		3										
C224.6		2										
AVG	3	2.67	2.5		2							3

Pre-Requisites for The Course:

Students are expected to have knowledge on the following topics:

S. No	
1.	Engineering Mathematics
2.	Engineering Physics

Course Description:

The course covers the basics of the electrostatic field—Gauss's law; boundary conditions; capacitance; Laplace's and Poisson's equations; energy and forces. The steady electric current. The magnetostatic field, vector potential; Ampere's and Biot-Savart laws; inductance; energy, forces, and torques. Quasi static fields; electromagnetic induction. It also deals with the propagation of Electromagnetic (EM) waves through guided and unguided media.

Course Content (syllabus):

UNIT I

Part-A:

Electrostatics : Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Illustrative Problems.

Part-B:

Fields in Materials :Convection, Conduction and Displacement Current Densities, Dielectric Constant, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations..Illustrative Problems.

UNIT II

Part-A:

Magneto Statics : Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials. Illustrative Problems**.**

Part-B:

Maxwell's Equations (Time Varying Fields): Faraday's Law and Transformer emf, Inconsistency of Ampere's Law, Maxwell's Equations in Different Final Forms and Word Statements. Conditions at a Boundary Surface: Dielectric-Dielectric and Dielectric-Conductor Interfaces. Illustrative Problems.

UNIT III

Part-A:

EM Wave Characteristics - I: Characterization of conductor and dielectric media**,** Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves – Definition, All Relations Between E & H,

Part-B:

EM Wave Characteristics - I:

Sinusoidal Variations, Wave Propagation Characteristics in dielectric and conductor media, Wave Propagation Characteristics in good dielectric and good conductor media, skin depth..Illustrative Problems.

UNIT IV

Part-A:

EM Wave Characteristics – II: Polarization & Types, Brewster Angle, Critical Angle ,Total Internal Reflection, Surface Impedance. Poynting Vector and Poynting Theorem – Applications Illustrative Problems.

Part-B:

EM Wave Characteristics – II: Reflections and Refractions of uniform plane waves by a perfect dielectric at normal & Oblique incidence, Reflections and Refractions of uniform plane waves by a perfect conductor at normal & Oblique incidence.

Text Books:

1. Elements of Electromagnetic – Matthew N.O. Sadiku, Oxford Univ. Press, 3rd ed., 2001.
2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2000.
3. Transmission Lines and Networks–Umesh Sinha,Satya Prakashan (Tech. India Publications), New Delhi, 2001.

Reference Books:

1. Electromagnetics- J***.D. Kraus***, "***Electromagnetics***", 4th Edition, Mc Graw-Hill. Inc, 1992.
2. Engineering Electromagnetics:Nathan Ida, Springer(India)Pvt.Ltd., New Delhi, 2nd ed., 2005.
3. Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, TMH, 7th ed., 2006.
4. Electromagnetic Field Theory and Transmission Lines: G Sasi Bhushana Rao,Wiley India 2013.

Control Systems

Name of the Program: B.Tech	**Academic Year: 2019-2020**
Branch: ECE	**Year & Semester: II & II**
Name of the Course: CONTROL SYSTEMS	**Regulation: NRIA18**
Course Area/Module: CONTROL SYSTEMS	**No. of students registered: 198**
Course Coordinator: **K. Venkata Kishore** **Designation:** **Associate Professor**	**Course Instructors:** **1. L. V. Mahesh Babu** **2. K. Sravan Sai Kumar**
No. of Lecture Hours per week:04	**No. of Tutorial Hours per week:01**
Credits:03	

Course objectives:

Students will be able to:

1. To learn the mathematical modeling of physical systems and to use block diagram algebra and signal flow graph to determine overall transfer function
2. To study the time response of first and second order systems and improvement of performance by proportional plus derivative and proportional plus integral controllers
3. To study the stability of closed loop systems using Routh's stability criterion and the analysis by root locus method.
4. To present the Frequency Response approaches for the analysis of linear time invariant (LTI) systems using Bode plots, polar plots and Nyquist stability criterion.
5. To learn basic aspects of design of linear control systems using Bode plots.
6. To study state models & analyze the systems and to present the concepts of Controllability & Observability

Course Outcomes:

At the end of the course, the students will develop ability to:

1.	Understand Closed/Open Loop Control Systems, derive the transfer function of physical systems and determine overall transfer function using block diagram algebra & signal flow graph reduction techniques
2.	Study different types of standard test signals, find the output response of first and second order systems, determine time response specifications of second order systems and determine steady state error along with error constants
3.	Acquire the skill to analyze absolute and relative stability of LTI systems using Routh-Hurwitz stability criterion and the Root Locus Plot
4.	Analyze the stability of LTI systems using frequency response methods using Bode plots & Polar Plots.
5.	Analyze the stability of LTI systems using frequency response methods using Nyquist Plots
6.	Represent physical systems by State Transition Matrices based state space modeling and determine the output response by understanding the concepts of controllability and observability

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-
CO5	3	2	2	2	-	-	-	-	-	-	-	-
CO6	2	-	-	3	-	-	-	-	-	-	-	-
Total	16	13	2	7	-	-	-	-	-	-	-	-
Avg.	2.67	2.6	2	2.33	-	-	-	-	-	-	-	-

Pre-Requisites for the Course:

Students are expected to have knowledge on the following topics:

S. No	Topic
1	Laplace Transforms, Matrix Algebra & Differential Equations **[Mathematics]**
2	Kirchoff's Laws, Mesh & Nodal Analysis **[Electrical Circuit Analysis]**
3	DC & AC Motor working principles **[Electrical Machines]**

Course Description:

This course introduces the elements of linear control systems and their analysis. Classical methods of design using frequency response. The state space approach for design, modeling and analysis of simple PD, PID controllers.

Course Content (Syllabus):

UNIT I
Introduction to Control Systems Components Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer function. Transfer Function of DC Servo motor - AC Servo motor- Synchro transmitter and Receiver, Block diagram representation of systems considering -Block diagram algebra – Representation by Signal flow graph - Reduction is using Mason's gain formula.
UNIT II
Time Response Analysis Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants, Introduction to P, PI, PD and PID controllers.
UNIT III
Stability Analysis in S-Domain The concept of stability – Routh's stability , limitations ,Routh-Hurwitz criterion – qualitative stability and conditional stability. **Root Locus Technique:** The root locus concept - construction of root loci –effects of adding poles and zeros to G(s) H(s) on the root loci.
UNIT IV

Frequency Response Analysis

Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and transfer function from the Bode Diagram- Phase margin and Gain margin-Stability Analysis from Bode Plots. Polar Plots- Nyquist Plots- Stability Analysis.

State Space Analysis of Continuous Systems

Concept of state, state variables and state model, derivation of state models from physical systems (Electrical), solving the Time invariant state Equations- State Transition Matrix and its Properties – Concepts of Controllability and Observability.

TEXT BOOKS:

1. Control Systems principles and design, M.Gopal, Tata McGraw Hill education Pvt Ltd., 4th Edition.
2. Automatic control systems, Benjamin C.Kuo, Prentice Hall of India, 2nd Edition.

REFERENCE BOOKS:

1. Modern Control Engineering, Kotsuhiko Ogata, Prentice Hall of India.
2. Control Systems, Manik Dhanesh N, Cengage publications.
3. Control Systems Engineering, I.J. Nagarath and M. Gopal, New Age International Publications, 5th Edition.
4. Control Systems Engineering, S.Palani, Tata McGraw Hill Publications.

E-RESOURCES:

1. http://nptel.ac.in/courses.php
2. http://jntuk-coeerd.in/
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/

Probability Theory & Stochastic Process

Name of the Program: B.Tech	**Academic Year: 2019-2020**
Branch: ECE	**Year & Semester:II-II**
Name of the Course: PTSP	**Regulation: NRIA18**
Course Area/Module: SIGNAL PROCESSING	**No. of students registered: 198**
Course Coordinator: P.VENU GOPAL **Designation:** **Associate Professor**	**Course Instructors:** **1.** P.VENU GOPAL **2.** R.UPENDRA RAO
No. of Lecture Hours per week:4	**No. of Tutorial Hours per week:--1**
Credits:3	

Course Objectives:

Students will be able to:

1. To give students an introduction to elementary probability theory, in preparation for courses on statistical analysis, random variables and stochastic processes.
2. To mathematically model the random phenomena with the help of probability theory concepts.
3. To introduce the important concepts of random variables and stochastic processes.
4. To introduce the types of noise and modeling noise sources.

Course Outcomes:

At the end of the course, the students will develop ability to:

1. Understand the axiomatic formulation of modern Probability Theory, Characterize probability models and random variables, function of random variables and formulate fundamental probability distribution and density functions.
2. Explain the concepts of expectation and conditional expectation, Evaluate and apply moments & characteristic functions, transformation of a random variable.
3. Understand the joint distribution function, joint density function, concept of inequalities, and operations on two random variables and multiple random variables.
4. Understand the concept of random processes and determine covariance, Analyze continuous and discrete- time random processes, Explain the concepts of stationary and wide sense stationary process, autocorrelation, cross correlation functions.
5. Understand the concept of random processes, spectral density of stationary random processes and cross power density spectrum, apply the above knowledge to solve basic problems.
6. Apply the theory of stochastic processes to analyze linear systems with random inputs and the systems in the presence of different types of noise sources.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2								
CO2	3	1	2	1								
CO3	3	2	3	1								
CO4	2	1	3	1								
CO5	2	1	-	2								
CO6	2	1	2	3								
Total	15	9	12	10								
Avg.	2.5	1.5	2	1.66								

Pre-Requisites for the Course:

Students are expected to have knowledge on the following topics:

S. No	Topic
1.	Calculus skills.
2.	Solution of ordinary differential equations.
3.	Fourier transform
4.	Linear Systems

Course Description:

Probability theory, Stochastic Processes and Statistical Signal Processing are essential for research in the area of Artificial Intelligence (AI), Signal Processing (SP) and Communication Engineering (CE) and many other fields, where there is uncertainty or randomness. Uncertainty or randomness is the common phenomena in the world. However, the probability theory and stochastic processes is a rich and sophisticated field of mathematics with a reputation for being confusion. This is due to either lack of basic concepts and knowledge of interpretation of these concepts to the real world problems where there is uncertainty. If some are good enough in the solving algebraic equations, they are not able to model or interpret the uncertainty of real world applications. If some people are able to model or interpret the real world applications with probabilistic equations, they are not able to solve them.

PTSP, which is essential for scientists and engineers working in the area of Artificial intelligence, Signal processing and communication, requires lot of practice for clear in-depth understanding to interpret and solve the problems.

Course Content (Syllabus):

UNIT I

THE RANDOM VARIABLE : Introduction, Review of Probability Theory, Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson,

Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties.

OPERATION ON ONE RANDOM VARIABLE – EXPECTATIONS : Introduction, Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Characteristic Function, Moment Generating Function.

UNIT II

MULTIPLE RANDOM VARIABLES: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density, Statistical Independence.

OPERATIONS ON MULTIPLE RANDOM VARIABLES: Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case.

UNIT III

RANDOM PROCESSES – TEMPORAL CHARACTERISTICS: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationary and Statistical Independence.First-Order Stationary Processes, Second-order and Wide-Sense Stationarity, N^{th}-order and Strict-Sense Stationarity.

Time Averages and Ergodicity, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

UNIT IV

RANDOM PROCESSES – SPECTRAL CHARACTERISTICS: The Power Density Spectrum: Properties, Relationship between Power Density Spectrum and Autocorrelation Function, Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Density Spectrum and Cross-Correlation Function.

Modeling of Noise Sources: Resistive (Thermal) Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Average Noise Figure, Average Noise Figure of cascaded networks.

Text Books:

1. Probability, Random Variables & Random Signal Principles, Peyton Z. Peebles, TMH, 4^{th} Edition, 2001.
2. Probability, Random Variables and Stochastic Processes, Athanasios Papoulis and S.Unnikrisha, PHI, 4^{th} Edition, 2002.

References:

1. Probability Theory and Stochastic Processes – B. Prabhakara Rao, BS Publications.
2. Probability and Random Processes with Applications to Signal Processing, Henry Stark and John W. Woods, Pearson Education, 3^{rd} Edition.
3. Schaum's Outline of Probability, Random Variables, and Random Processes.
4. An Introduction to Random Signals and Communication Theory, B.P. Lathi, International Textbook, 1968.
5. Random Process – Ludeman , John Wiley
6. Probability Theory and Random Processes, P. Ramesh Babu, McGrawHill, 2015.

OOPS through JAVA (Open Elective)

<table>
<tr><td>Name of the Program &Branch</td><td colspan="2">B.Tech & Electronic communications and Engineering</td><td colspan="2">Academic Year& Semester</td><td>2019-2020 & II Semester</td></tr>
<tr><td>Course Title</td><td colspan="2">OOPS through JAVA</td><td colspan="2">Course Type</td><td>Theory</td></tr>
<tr><td>Course Structure</td><td>Lecture –
Tutorial –
Practical–</td><td>3
0
0</td><td colspan="2">Contact Hours</td><td>3</td></tr>
<tr><td>Number of Credits</td><td>3</td><td colspan="3">Total No. of Classes per Semester</td><td>60</td></tr>
<tr><td>Course Code</td><td></td><td colspan="2">Theory Hours</td><td>60</td><td>Lab Hours</td><td>0</td></tr>
<tr><td>Regulation</td><td>NRIA18</td><td colspan="2">Course Area/Module</td><td colspan="2">Programming</td></tr>
<tr><td colspan="2">Name of the Course Coordinator and Department</td><td colspan="2">Course Instructors for Theory</td><td colspan="2">Course Instructors for Practical</td></tr>
<tr><td colspan="2">K.Vamsi Krishna
Computer Science and Engineering</td><td colspan="2">K.Vamsi Krishna
S.Asha Varma</td><td colspan="2">----</td></tr>
<tr><td rowspan="3">Assessment in Marks</td><td rowspan="3">100</td><td>Internal total</td><td>40</td><td>External Total</td><td>60</td></tr>
<tr><td>Internal Theory Marks</td><td>40</td><td>External Theory Marks</td><td>60</td></tr>
<tr><td>Internal Practical Marks</td><td>00</td><td>External Practical Marks</td><td>00</td></tr>
<tr><td colspan="2">Date of Commencement</td><td>18-11-2019</td><td colspan="2">Date of Closure</td><td></td></tr>
<tr><td colspan="5">Total No. of students registered</td><td></td></tr>
</table>

Course Description:

Java is the most popular platform, which is used to develop several applications for the systems as well as embedded devices like mobile, laptops, tablets and many more. It is an object oriented programming language and has a simple object model, as it has derived from C and C++. It provides a virtual machine, which is accumulated with byte-code and can run on any system. With time the importance and popularity of Java is on rise as it has the magic in its remarkable abilities to innovate and morph as the technology landscape changes. It is the

language of choice for developing applications for the BlackBerry Smartphone. It is important for information technology industry to develop and create multiple web-based or server based applications to enhance the industrial competency. There is huge scope for this programming language

Course Objectives:

Students will be able to:

1.	To **introduce** the object oriented programming concepts.
2.	To **understand** object oriented programming concepts, and apply them in solving Problems.
3.	To **introduce** the principles of inheritance and polymorphism; and demonstrate how they relate to the design of abstract classes
4.	To **introduce** the implementation of packages and interfaces
5.	To **introduce** the concepts of exception handling and multithreading.
6.	To **introduce** the design of Graphical User Interface using applets.

Course Outcomes:

At the end of the course, the students will develop ability to:

1.	Able to **solve** real world problems using OOP techniques.
2.	Able to **understand** the use of abstract classes and Packages in java.
3.	Able to **develop** and **understand** exception handling and Interfaces in java
4.	Able to understand multithreaded applications with synchronization and **design** GUI based applications and **develop** applets for web applications

Courses Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C125.1	3	3	-	-	-	-	-	-	-	-	-	3
C125.2	3	3	3	-	-	-	-	-	-	-	-	3
C125.3	3	3	3	2	-	-	-	-	2	-	-	3
C125.4	3	3	3	2	-	-	-	-	2	-	-	3
Total	12	12	9	4	-	-	-	-	4	-	-	12
Average	3	3	2	0.67	-	-	-	-	0.67	-	-	3

Pre-Requisites for the Course:

Students are expected to have knowledge on the following topics:

S. No	Topic
1	Basic Knowledge on computer usage
2	Basic knowledge on C

Course Content (syllabus):

UNIT I

Introduction to OOP, Procedural Programming Language and Object Oriented Language, Principles of OOP, Applications of OOP, History of Java, Java features, Java

Virtual Machine (JVM), Java Program Structure, Variables, Primitive data types, Identifiers, Literals – Examples, Operators, expressions – Examples, Precedence Rules and Associativity, Primitive Type Conversion and Casting, Flow of Control, Classes and objects, Class Declaration, Creating Objects, Methods, Method Overloading

UNIT II

Constructors – Examples, Constructor Overloading, Garbage collector, Importance of static overriding, keyword and examples, this keyword – Examples, Arrays, command line arguments, Nested Classes., Inheritance, types of inheritance, Forms of Inheritance, super keyword, final keyword, Polymorphism an its and implementation, Method Creating the packages, using packages, importance of CLASSPATH, Access Protection, importing packages.

UNIT III

Interfaces, implementing interfaces, Nested Interfaces, Variables in interfaces, Multiple inheritance of interfaces, Differences between abstract class & interfaces, Exception handling, importance of try, catch, throw, throws and finally block, user-defined exceptions, Assertions.

UNIT IV

Multithreading: Introduction, differences, Thread life cycle, Creation of threads, Thread priorities, Thread Synchronization, Communication between Threads. Reading data from files and writing data to files, Files & random access file, Applet class, Applet structure, Applet life cycle, sample Applet programs,

Text Books:

1. The Complete Reference Java, 8th edition, Herbert Schildt, TMH.
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.

Reference Books:

1. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John Wiley & sons.
2. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
3. Object Oriented Programming through Java, P. Radha Krishna, Universities Press.
4. Programming in Java, S. Malhotra, S. Chudhary, 2nd edition, Oxford Univ. Press.
5. Java Programming and Object oriented Application Development, R. A. Johnson, Cengage Learning.

e-Resources:

1. http://www.javatpoint.com/
2. java.sun.com/docs/books/tutorial/java/TOC.html
3. http://www.learnjavaonline.org/
4. http://www.tutorialspoint.com/java/

Professional Ethics and Human Values

(Common to all branches)

Lecture – Tutorial:	0-2	**CIA:**	40
Credits:	0	**SEA:**	60

Prerequisites:

Course Objectives:

- To create awareness on engineering ethics and human values.
- To understand social responsibility of an engineer.
- To instill moral and social values and loyalty.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Grooms themselves as ethical, responsible and societal beings.
CO2	Discuss ethics in society and apply the ethical issues related to engineering.
CO3	Exhibit the understanding of ethical theories in professional environment.
CO4	Recognize their role as social experimenters (engineers) and comprehend codes of ethics.
CO5	Identify the risks likely to come across in the professional world, analyzing them and find solutions.
CO6	Realize the responsibilities and rights of engineers in the society.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						1	1	2				1
CO2						1	1	2				1
CO3						1	1	2				1
CO4						1	1	2				1
CO5						1	1	2				1
CO6						1	1	2				1

UNIT I

Human Values: Objectives, Morals, Values, Ethics, Integrity, Work ethics, Service learning , Virtues, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time,Cooperation, Commitment, Empathy, Self-confidence, Challenges in the work place.

UNIT II

Engineering ethics

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III

Engineering as Social Experimentation: Engineering as experimentation, Engineers as responsible experimenters, Codes of ethics, Industrial standards, A balanced outlook on law, Case study: The challenger.

UNIT IV

Safety, Responsibilities and Rights: Safety and risk, types of risks, Assessment of safety and risk, Safe exit, Risk-benefit analysis, safety lessons from 'the challenger' , Case study: Power plants, Collegiality and loyalty, Collective bargaining, Confidentiality, Conflict of interests, Occupational crime, whistle blowing, Intellectual property rights, professional rights.

Text Books:

- A Text book on Professional Ethics and Human Values by R.S Naagarazan- New Age International Publishers.
- " Engineering Ethics includes Human Values" by M. Govindarajan, S. Natarajan and V. S. Senthil Kumar- PHI Learning Pvt. Ltd-2009

Reference Books:

"Professional Ethics and Human Values" by A. Alavudeen, R. Kalil Rahman and M. Jayakumaran- Laxmi Publications.

E-Resources:

- www.onlineethics.org
- www.nspe.org
- www.globalethics.org
- www.ethics.org

Analog Communications Laboratory

LIST OF EXPERIMENTS

All the Following Experiments must be conducted

1. Amplitude Modulation & Demodulation
2. Diode detector characteristics
3. DSB SC - Modulation & Demodulation.
4. Frequency Modulation & Demodulation
5. Pre-emphasis & De-emphasis
6. AGC Circuits characteristics
7. Verification of Sampling Theorem
8. Pulse Amplitude Modulation & Demodulation.
9. PWM, PPM Modulation & Demodulation
10. Radio receiver characteristics

Equipment required:

1. RPS	-	(0 – 30) V
2. CRO	-	(0 – 20) M Hz.
3. Function Generators	-	(0 – 1) M Hz
4. Trainer kits		

Analog and Pulse Circuits Laboratory

Note: The students are required to design the circuit and verify the result using necessary hardware equipment

All the following Experiments should be conducted in laboratory

List of Experiments :

1. CE Amplifier
2. Current Shunt Feedback Amplifier
3. RC Phase Shift Oscillator
4. Colpitt's Oscillator
5. Class A Series fed Power Amplifier
6. Linear Waveshaping Circuits
7. Non Linear Waveshaping Circuits – Clippers
8. Non Linear Waveshaping Circuits – Clampers
9. Monostable Multivibrator
10. Astable Multivibrator

Equipment required for Laboratory:

1. RPS - 0 – 30 V
2. CRO - 0 – 20 M Hz.
3. Function Generators - 0 – 1 M Hz
4. Digital Multimeters
5. Decade Résistance Boxes/Rheostats
6. Decade Capacitance Boxes
7. Decade Inductance Boxes
8. Active & Passive Electronic Components

Content beyond syllabus:

Multisim/ Equivalent Industrial Standard Licensed simulation software tool

Digital Electronics & Logic Design Laboratory

LIST OF EXPERIMENTS

All the following Experiments should be conducted in laboratory

1. Verification of basic logic gates
2. Verification of universal logic gates
3. Design & verify the circuit for given canonical expression.
4. Design & verify 4X1 Multiplexer.
5. Design & verify 1X4 De-Multiplexer.
6. Construct half adder & Full adder using half adder & verify truth tables.
7. Construct half subtractor & Full subtractor using half subtractor & verify truth tables.
8. Verify the truth tables of various Flip – Flops.
9. Design & verification of Decade counter.
10. Design & verification of 4 – bit ring counter using D Flip – flop.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE STRUCTURE FOR THIRD YEAR B.TECH PROGRAMME-NRIA 18

III YEAR I SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	PC	Linear and Digital Integrated Circuits	3	1	-	4	40	60	100	4
2	PC	Digital Communications	3	1	-	4	40	60	100	4
3	PC	Antennas and Wave Propagation	3	1	-	4	40	60	100	4
4	PE	**Professional Elective I** **i.** Electronic measurements & Instrumentation **ii.** Telecommunication Switching and Networks **iii.** Computer Architecture & Organization	3	-	-	3	40	60	100	3
5	OE	**Open Elective III**	3	-	-	3	40	60	100	3
6	MC	IPR and Patents	2	-	-	2	40	60	100	0
7	PC LAB	Linear and Digital Integrated Circuits Laboratory	-	-	2	2	40	60	100	1
8	PC LAB	Digital Communications Laboratory	-	-	2	2	40	60	100	1
9	PC LAB	VHDL Programming Laboratory	-	-	2	2	40	60	100	1
Total			**17**	**3**	**6**	**26**	**360**	**540**	**900**	**21**

III YEAR II SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	PC	VLSI Design	3	1	-	4	40	60	100	4
2	PC	Digital Signal Processing	3	1	-	4	40	60	100	4
	PC	Microprocessors and Microcontrollers	3	1	-	4	40	60	100	4
4	PE	Professional Elective II i. Cellular and Mobile Communication ii. Digital System Design iii. Electromagnetic Interference & Electromagnetic Compatibility	3	-	-	3	40	60	100	3
5	OE	Open Elective IV	3	-	-	3	40	60	100	3
6	PC LAB	Microprocessors and Microcontrollers Laboratory	-	-	2	2	40	60	100	1
7	PC LAB	Digital Signal Processing Laboratory	-	-	2	2	40	60	100	1
8	PC LAB	VLSI Laboratory	-	-	2	2	40	60	100	1
Total			**15**	**3**	**6**	**24**	**320**	**480**	**800**	**21**

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B.TECH ECE
III- I SEMESTER

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III Year - I Semester **L T P C**
3 1 0 4

Linear and Digital Integrated Circuits

Lecture – Tutorial:	3 -1 Hours	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

Prerequisites: Electronic Devices & Circuits, Digital Electronics & Logic Design, and Pulse & Digital Circuits

Course Objectives:

- To understand the basic operation &performance parameters of differential amplifiers.
- To understand & learn the measuring techniques & performance parameters of OP-AMP.
- To learn the linear and non-linear applications of operational amplifiers.
- To understand the analysis & design of different types of active filters using OP-AMP.
- To learn the internal structure, operation and applications of different ICs.
- To Design and implementation of combinational and sequential digital logic circuits.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Apply Differential amplifier circuits and gains knowledge in OP-AMPs.
CO2	Differentiate and gain knowledge in various applications of O-PAMPS.
CO3	Analyze and design amplifiers and active filters using Op-amp.
CO4	Interpret the operational amplifiers with linear integrated circuits.
CO5	Understand basic digital circuits with combinatorial and sequential logic circuits.
CO6	Apply the structures of commercially available Analog & Digital integrated circuit families.

Course Content(Syllabus)

UNIT I

DIFFERENTIAL AMPLIFIERS: Introduction, DC and AC analysis of Dual input Balanced output Configuration, Properties of other differential amplifier configurations, Integrated circuits-Types, Classification, Package Types and Temperature ranges, Power supplies.

OP-AMPS: Introduction to OP-amp, Characteristics of OP-Amps, Op-amp Block Diagram, ideal and practical Op-amp Specifications, DC and AC characteristics, 741 op-amp & its features, Op-Amp parameters & Measurement, Input & Output Off set voltages & currents, Slew rate, CMRR, PSRR, drift.

UNIT II

OP-AMP APPLICATIONS: Inverting and Non-Inverting amplifiers, Difference Amplifier, Instrumentation Amplifier, AC Amplifier, Differentiator and Integrator; Comparator, Triangular, Saw-tooth and Square Wave generators, Schmitt Trigger, Log and Anti log Amplifiers.

OP-AMP FILTERS: Introduction to Active Filters, Characteristics of Low pass, high pass, band pass, band reject and all pass filters. Design and analysis of Butterworth active filters--1st - 2nd order LPF, HPF,BPF,BRF and All pass filters.

UNIT III

TIMERS & PHASE LOCKED LOOPS: Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications, Schmitt Trigger; PLL - introduction, block schematic, principles and description of individual blocks, 565 PLL, Applications of PLL – frequency multiplication, frequency translation and Amplitude Modulation.

D/A and A/D CONVERTERS: Introduction, Basic DAC techniques, Different types of DACs-Weighted

resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT IV

COMBINATIONAL LOGIC DESIGN ICs: Decoders-74x138, 74x139, Encoders-74x148 Priority Encoder, Multiplexers-74x151 MUX, Demultiplexers -74X155, Barrel shifter.

SEQUENTIAL LOGIC DESIGN ICs: 8-Bit Latch 74x373, Flip Flops-D Flip Flop74X74, JK Flip Flop74X109, Counters- 74x163 4-Bit Binary Counter, 74X163 as Modulus-N Counter, Universal Shift Register 74x194.

TEXT BOOKS:

1. 1. Linear Integrated Circuits – D. Roy Choudhury, New Age International (p) Ltd, 2nd Edition,2003.
2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI,1987.
3. Operational Amplifiers–C.G. Clayton, Butterworth & Company Publ. Ltd./Elsevier, 1971
4. Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3rd Ed., 2005.

REFERENCES:

1 Operational Amplifiers & Linear Integrated Circuits –Sanjay Sharma ;SK Kataria Sons;2nd Edition,2010
2. Design with Operational Amplifiers & Analog Integrated Circuits – Sergio Franco, McGraw Hill, 1988.
3. Operational Amplifiers & Linear ICs – David A Bell, Oxford Uni. Press, 3rd Edition
4. Fundamentals of Digital Logic Design- Stephen Brown, ZvonkoVranesic, McGrawHill

E-Resources :

1. https://www.tutorialspoint.com/linear_integrated_circuits_applications/index.htm
2. https://www.electronics-tutorials.ws/opamp
3. https://www.elprocus.com/operational-amplifiers/
4. http://www.ee.surrey.ac.uk/Projects/CAL/seq-switching/General_seq_circ.htm
5. https://www.electronics-tutorials.ws/combination/comb_1.html

Contribution of Course Outcomes towards achievement of Program Outcomes (PO) and Program Specific outcomes (PSO)
(1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2
CO1	3	2	-	2	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	2	-	-	-	3	-	-	-	-	3	-
CO3	-	3	-	-	3	-	-	-	-	-	2	-	-	-
CO4	3	-	-	3	-	3	-	-	-	2	-	-	-	2
CO5	2	2	-	-	-	-	2	-	-	-	-	-	3	-
CO6	-	2	-	2	-	-	-	-	-	2	-	-	3	2

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III Year - I Semester **L T P C**
3 1 0 4

DIGITAL COMMUNICATIONS

Lecture – Tutorial:	3-1 Hours	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

Prerequisites: Basics of Communications, Signals and Systems and Probability and Random processes.

Course Objectives:

1. To acquire basic knowledge of digital communication systems and its advantages.
2. To analyze various pulse digital and digital modulation techniques and their error performance.
3. To understand and analyze various source coding and channel coding techniques.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Apply the knowledge of statistical theory of communication and understand the basics of digital communication systems.
CO2	Analyze the performance of digital modulation techniques for generation, detection and digital representation of the signal.
CO3	Explore the probability of error for various digital modulation techniques with the help of random variables and filters.
CO4	Integrate and apply the basics of information theory to the communication and compute entropy, information rate of the source.
CO5	Understand and analyze the source coding techniques and channel capacity.
CO6	Compute and analyze different error control coding schemes for reliable transmission of digital information over the channel.

Course Content (Syllabus)

UNIT I

INTRODUCTION TO DIGITAL COMMUNICATION:

Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization & Coding, Quantization error, Companding in PCM systems.

Differential PCM systems (DPCM). Delta modulation, its draw backs, adaptive delta modulation, comparison of PCM and DM systems.

UNIT II

Introduction, Line Codes, ASK, FSK, PSK, DPSK, DEPSK, QPSK, coherent reception, non-coherent detection, M-ary PSK, ASK, FSK.

Probability of error, the optimum filter, matched filter, probability of error using matched filter, calculation of error probability of ASK, BPSK, BFSK, QPSK.

UNIT III

INFORMATION THEORY:

Discrete messages, concept of amount of information and its properties. Average information, Entropy and its properties. Information rate, Mutual information and its properties.

SOURCE CODING:

Introductions, Advantages, Shannon's theorem, Shanon-Fano coding, Huffman coding, efficiency calculations, channel capacity of discrete and analog Channels, capacity of a Gaussian channel, bandwidth –S/N trade off.

UNIT IV

LINEAR BLOCK CODES:

Introduction, Matrix description of Linear Block codes, Error detection and error correction capabilities of Linear block codes, Hamming codes, Binary cyclic codes, Algebraic structure, encoding, syndrome calculation.

CONVOLUTION CODES:

Introduction, encoding of convolution codes, Graphical approach: state, tree and trellis diagram, decoding using Viterbi algorithm.

TEXT BOOKS:

1. Digital communications - Simon Haykin, John Wiley, 2005

2. Principles of Communication Systems – H. Taub and D. Schilling, TMH, 2003

REFERENCES:

1 Digital and Analog Communication Systems - Sam Shanmugam, John Wiley, 2005.

2. Digital Communications – John Proakis, TMH, 1983. Communication Systems- Analog & Digital – Singh & Sapre, TMH, 2004.

3. Modern Analog and Digital Communication – B.P.Lathi, Oxford reprint, 3rd edition, 2004.

Contribution of Course Outcomes towards achievement of Program Outcomes (PO) and Program Specific outcomes (PSO) (1 – Low, 2- Medium, 3 – High)

	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	-	-	-	3	-	-	3
CO2	-	3	2	-	-	2	-	-	-	-	-	-	2	-
CO3	2	-	-	3	-	-	-	-	2	-	-	2	-	-
CO4	-	2	-	2	-	-	-	-	-	3	-	-	-	3
CO5	2	-	3	-	-	-	-	3	-	-	-	2	-	-
CO6	-	3	2	-	3	-	-	-	-	-	-	-	-	2

III Year - I Semester

L	T	P	C
3	1	0	4

ANTENNAS AND WAVE PROPAGATION

Lecture – Tutorial:	3-1 Hours	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

Prerequisites: EM Waves and Transmission Lines.

Course Objectives:

- To introduce the fundamental principles of antenna theory and to apply them for the analysis, design.
- To introduce to the design principles of different antenna arrays.
- To understand the radiation mechanism of various types of antennas and also to learn about the basic parameters of antennas and their measurement.
- To understand the wave propagation over ground and through different layers of atmosphere.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the basic antenna radiation parameters and radiation mechanism of single wire & two wire antennas with current distribution analysis.
CO2	Quantify the radiation fields and powers radiated by dipole antennas also analyze their radiation characteristics using mathematical approach.
CO3	Illustrate the different types of arrays and their radiation patterns with both mathematical and geometrical analysis.
CO4	Understand the geometry and working principle of operation of non resonant radiators and micro strip antennas with qualitative analysis.
CO5	Design Microwave antennas also Analyze antenna measurements to assess antenna's performance.
CO6	Identify and distinguish the characteristics of different modes of radio wave propagation in the atmosphere with both qualitative and quantitative treatment.

Course Content(Syllabus)

UNIT I

Part-A (Antenna Fundamentals): Introduction, Radiation Mechanism – single wire, 2 wire. Antenna Parameters - Radiation Patterns, Patterns in Principal Planes, Main Lobe and Side Lobes, Beamwidths, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, ,Antenna Apertures, Aperture Efficiency, Effective Height, illustrated Problems.

Part-B(Thin Linear Wire Antennas): Retarded Potentials, Dipoles, Current Distribution on a thin wire antenna ,Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Directivity, Effective Area . Natural current distributions and patterns of Thin Linear Center-fed Antennas of different lengths.

UNIT II

Part-A(Antenna Arrays-I):2 element arrays – different cases, Principle of Pattern Multiplication, N element Uniform Linear Arrays – Broadside, End-fire Arrays, EFA with Increased Directivity,

Directivity Relations (no derivations). Related Problems.

Part-B(Antenna Arrays-II): Concept of Scanning Arrays. Binomial Arrays, Effects of Uniform and Non-uniform Amplitude Distributions, Design Relations. Arrays with Parasitic Elements, Yagi-Uda Arrays.

UNIT III

Part-A(Non-Resonant Radiators) : Introduction, Traveling wave radiators – basic concepts, Long wire antennas –field strength calculations and patterns, Helical Antennas – Significance, Geometry, basic properties; Design considerations of helical antennas in Axial Mode and Normal Modes (Qualitative Treatment).

Part-B(Microstrip Antennas): Introduction, Definition, Basic geometry , Features, Advantages and Limitations, Different Shapes of patch elements, Rectangular Patch Antennas –Geometry and Parameters, Radiation Mechanism of Microstrip antenna. Characteristics of Microstrip antennas, Impact of different parameters on characteristics.

UNIT IV

Part-A(Microwave Antennas): Paraboloidal Reflectors – Geometry, characteristics, types of feeds, Spill Over, Back Lobes, Aperture Blocking, Cassegrain Feeds. Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns; Antenna Measurements – Directivity and Gain Measurements.

Part-B(Wave Propagation): Concepts of Propagation – frequency ranges and types of propagations. Ground Wave Propagation–Characteristics, Parameters, Wave Tilt.Sky Wave Propagation – Formation of Ionospheric Layers and their Characteristics, Mechanism of Reflection and Refraction, Critical Frequency, MUF and Skip Distance , Optimum Woking Frequency, , Virtual Height, Ionospheric Abnormalities,. Fundamental Equation for Free-Space Propagation, Space Wave Propagation– Mechanism, LOS and Radio Horizon. Effective Earth's Radius, Duct Propagation, Tropospheric Scattering.

TEXT BOOKS:

1. Antennas and Wave Propagation– John D. Kraus and Ronald J. Marhefka, 4th Edition, TMH, 2010.

2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition.

REFERENCES:

1. Antenna Theory - C.A. Balanis, John Wiley and Sons, 2nd Edition, 2001.

2. Antennas and Wave Propagation – K.D. Prasad, Satya Prakashan, Tech India Publications, New Delhi, 2001.

3. Micro strip Antenna Design Hand Book – Ramesh Garg, Prakash Bhartia,Inder Bahl, Apisak Ittipiboon, Artech House, second edition 2001

4. Transmission and Propagation – E.V.D. Glazier and H.R.L. Lamont, The Services Text Book of Radio, vol. 5,Standard Publishers Distributors, Delhi.

5. Electronic and Radio Engineering – F.E. Terman, McGraw-Hill, 4th Edition, 1955.

6. Antennas – John D. Kraus, McGraw-Hill, 2nd Edition, 1988

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	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	-	3	3	2	-	-	2	2	-	-	-	-	-	3
CO3	2	3	-	3	-	-	-	-	-	-	-	-	-	-
CO4	2	-	3	3	-	-	-	-	-	-	2	-	-	3
CO5	2	3	-	-	-	2	-	2	-	-	-	-	2	-
CO6	-	3	2	-	-	-	-	-	-	-	-	-		-

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III Year - I Semester **L T P C**
3 0 0 3

PROFESSIONAL ELECTIVE – I
ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Electrical circuits, Electronic Devices and circuits.

Course Objectives:

- Introduce the basic concepts related to the operation of electronic measuring instruments.
- Acquire a sound understanding theory and performance characteristics of instruments and errors in measurement and apply to DC voltmeters, ammeters, ohmmeters.
- To analyze fundamental characteristics of Micro strip lines through electromagnetic field concepts.
- Compare and contrast different types of oscilloscopes.
- Select different types of D.C and A.C bridges for measurement of passive components.
- Study the principles behind various transducers and their applications in the measurement of various parameters.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the fundamental concepts instrumentation, basic concepts of measuring systems and characteristics of measuring systems.
CO2	Describe different types of meters and understanding the operation of meters.
CO3	Analyze Different types of signal generators and signal analyzers and their working principles.
CO4	Interpret the different types of Oscilloscopes and their working principles.
CO5	Explore the different types of A.C. and DC Bridges and their operations.
CO6	Demonstrate the different types of transducers and their principles and operations.

Course Content(Syllabus)

UNIT I

Performance Characteristics of Instruments: Block Schematic of Measuring Systems, Static characteristics, Accuracy, Resolution, Precision, Expected value, Error, Sensitivity. Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error, Types of Errors.

DC & AC Meters: Basic DC Voltmeter, Multi-range Voltmeters, Range extension/Solid state and differential voltmeters, AC voltmeters, Digital Voltmeters: Ramp Type, Staircase, Dual slope integrating type, Successive Approximation type, Ohmmeters series type, shunt type, Multi-meter for Voltage, Current and resistance measurements.

UNIT II

Signal Generators: fixed and variable AF oscillators, Standard AF sine and square wave signal generators, Function Generator, Square pulse, Random noise, sweep, Arbitrary waveform generator.

Wave Analyzers: Harmonic Distortion Analyzer,Spectrum Analyzer,Digital Spectrum Analyzer,

Digital Fourier Analyzer, Power analyzer.

UNIT III

Oscilloscopes: CRT, Block Schematic of CRO, vertical amplifiers**,** horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits.

Special Oscilloscopes: Dual beam CRO, Dual trace oscilloscope, sampling oscilloscope, digital readout oscilloscope, digital storage oscilloscope, Lissajous method of frequency measurement, standard specifications of CRO, probes for CRO- Active & Passive, attenuator type.

UNIT IV

Bridges: Measurement of Resistance – Wheatstone,Kelvin Bridge, Measurement of inductance-Maxwell's bridge, Anderson Bridge. Measurement of capacitance - Shearing Bridge. Wheat stone bridge. Wien Bridge.

Transducers- active & passive transducers : Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Sensistors. Measurement of physical parameters force, pressure, velocity, humidity, moisture, speed. Basic block diagram of Data acquisition systems, single channel and multi-channel DAS.

TEXT BOOKS:

1. Electronic Instrumentation, second edition-H.S.Kalsi, Tata McGraw Hill, 2004.
2. Modern Electronic Instrumentation and Measurement Techniques- A.D.Helfrick and W.D.Cooper, PHI, 5th Edition, 2002.

REFERENCES:

1. Electronic Instrumentation & Measuements- David A. Bell, PHI,2nd Edition,2003.
2. Electronic Measurements and Instrumentation by K.Lal Kishore, Pearson Education-2005.

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	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	-	-	3	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	3	-	-	3	-	3	-	-	-	-
CO3	2	-	-	-	-	-	-	-	3	-	-	3	-	-
CO4	-	-	-	2	-	3	-	-	-	-	-	-	3	-
CO5	3	3	-	2	-	-	3	-	-	-	2	-	-	2
CO6	3	-	3	-	-	-	-	-	-	-	-	-	2	-

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III Year - I Semester **L T P C**
3 0 0 3

TELECOMMUNICATION SWTICHING NETWORKS
PROFESSIONAL ELECTIVE - I

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Fundamental knowledge of Analog and Digital circuits, Basic knowledge of Analog and Digital Communication, Analytical skills for communication systems and mathematical knowledge.

Course Objectives:

- To understand various switching systems.
- To learn in detail about stored program control.
- To know about time division switching concepts.
- To study the basic telephone network structures.
- To understand various internet concepts like LAN, WAN and MAN.
- To gain knowledge on telecommunication traffic and ISDN.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Analyze the need for switching systems and their evolution from analog to digital.
CO2	Explore the types of stored program control.
CO3	Interpret the concepts of space switching, time switching and combination switching.
CO4	Differentiate between signalling methods used in telecommunication networks.
CO5	Exhibit good knowledge on data communication networks and be able to differentiate LAN, WAN and MAN.
CO6	Demonstrate and work on telecommunication traffic and ISDN services.

Course Content(Syllabus)

UNIT I

UNIT I:
INTRODUCTION:
Evolution of telecommunications, Basics of switching system – general principle and elements, Classification of switching system.

CROSSBAR SWITCHING:
Principles of crossbar switching, Crossbar switch configurations, Cross point technology, Crossbar exchange organization.

UNIT II

ELECTRONIC SPACE DIVISION SWITCHING:
Stored program control, Centralized SPC, Distributed SPC, Enhanced services, Two stage networks, Three stage networks, n stage networks.

TIME DIVISION SWITCHING:
Time multiplexed space switching, Time multiplexed time switching, Combination switching, Three stage Combination switching, n stage Combination switching.

UNIT III

TELEPHONE NETWORKS:
Subscriber loop systems, Switching hierarchy and routing, Transmission plan, Transmission systems, Numbering plan, Charging plans, In channel signalling, Common channel signalling.

PUBLIC SWITCHED DATA NETWORKS:
Connection oriented and Connection less service, Circuit switching, Packet switching, Virtual switching concepts, LAN, WAN, MAN, Internetworking.

UNIT IV

TELECOMMUNICATION TRAFFIC:
The unit of traffic, Congestion, Traffic measurement, A mathematical model, Lost call systems, Queuing systems.

INTEGRATED SERIVES DIGITAL NETWORK:
Introduction, Motivation, New services, Network and protocol architecture, Transmission channels, User network interfaces, Signaling, Numbering &Addressing, Service characterization, Internetworking, ISDN standards, Broadband ISDN.

TEXT BOOKS:

1. **Telecommunication switching system and networks** – Thyagarajan Viswanath, PHI, 2000
2. J. E Flood, **"Telecommunications Switching and Traffic Networks,"** Pearson Education, 2006
3. **Data Communication & Networking** - B.A. Forouzan, TMH, 4 Edition, 2004.
4. **Digital telephony** - J. Bellamy, John Wiley, 2nd edition, 2001.

REFERENCES:

1. **Data Communications & Networks** - Achyut. S. Godbole, TMH, 2004.
2. **Principles of Communication Systems** – H. Taub & D. Schilling, TMH, 2nd Edition, 2003.

An Engineering approach to computer networking -S.Keshav, Addison W

E-Resources:

1. www.modernelectronics.org
2. www.electronicsforyou.com
3. www.npteliitm.ac.in

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	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	-	-	-	-	3	-	-	-
CO2	2	3	-	-	2	-	-	2	-	-	-	-	3	-
CO3	-	-	3	-	2	-	-	-	3	-	-	-	-	2
CO4	-	3	2	-	-	-	-	-	-	2	-	-	3	-
CO5	3	-	3	-	-	-	-	3	-	-	-	-	-	-
CO6	-	-	3	-	-	-	3	-	-	-	-	-	-	-

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III Year - I Semester

L	T	P	C
3	0	0	3

COMPUTER ARCHITECTURE AND ORGANISATION

PROFESSIONAL ELECTIVE - I

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Computer Fundamentals, Programming Concepts

Course Objectives:

- Understand the architecture of a modern computer with its various processing units.
- Understand the Performance measurement of the computer system.
- Understand the memory management system of computer.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Gain the knowledge of the computer architecture of modern computers.
CO2	Analyse the performance of a computer using performance equations.
CO3	Identify the fundamentals of different instruction set architectures and their relationship to the CPU design.
CO4	Gain the knowledge on the memory system and multi programmed concepts.
CO5	Identify the operation of modern CPUs including interfacing, pipelining, memory systems and busses.
CO6	Gain the knowledge on the principles of operation of multiprocessor systems.

Course Content(Syllabus)

UNIT I

Basic Structure Of Computers: Functional unit, Basic Operational concepts, Bus structures, System Software, Performance, The history of computer development.
Central Arithmetic: Data representation,Addition and Subtraction Algorithms, Multiplication Algorithms, Division Algorithms, Floating Point Arithmetic Operations.

UNIT II

Machine Instruction Sequencing: Register Transfer Notation, Assembly Language Notation, The role of Stacks and Queues in computer programming equation, Addressing Modes.
Type of Instructions: Basic Instruction Types, Data transfer Instructions, Arithmetic Instructions, Logical Instructions, shift and Rotate Instructions, Branch Instructions.

UNIT III

Micro Programmed Control: Control Memory, Address Sequencing, Micro Program Example, Hard Wired Control, Micro Programmed Control.
The Memory System: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

UNIT IV

Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer Modes, Priority Interrupt, Direct Memory Access, Serial Communication.

Pipeline and Multiprocessors: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processing, Interconnection Structures, Cache Coherence.

TEXT BOOKS:

1. Computer System Architecture – M.Moris Mano, IIIrd Edition, PHI / Pearson, 2006.
2. Computer Organization – Car Hamacher, ZvonksVranesic, SafwatZaky, V Edition, McGraw Hill, 2002.

REFERENCES:

1. Computer Organization and Architecture – William Stallings Seventh Edition, PHI/Pearson, 2006.
2. Computer Architecture and Organization – John P. Hayes, McGraw Hill International editions, 1998.
3. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition PHI/Pearson.
4. Fundamentals or Computer Organization and Design, - SivaraamaDandamudi Springer Int. Edition.
5. "Computer Organization and Design: The Hardware/Software Interface" by David A. Patterson and John L. Hennessy.

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2
CO1	3	-	-		2	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	2	-	-	-	-	2	-	-	3	-
CO3	2	-	3	-	-	-	-	-	2	-	-	-	-	2
CO4	3	2	3	-	-	-	-	-	-	-	-	-	3	-
CO5	2	2	3	-	2	-	-	-	-	2	-	-	-	-
CO6	2	-	3	-	-	-	-	-	-	-	-	-	-	-

III Year - I Semester **L T P C**
0 0 2 1

Linear and Digital Integrated Circuits Lab

Minimum 10 experiments should be conducted.
{ 8 experiments from part A and 2 experiments from part B}

Pre-Requisites: EDC LAB, DLED LAB & APC LAB,

Course Outcomes: The Students will be able to

- Have a thorough understanding of operational amplifier (741).
- Design circuits using operational amplifiers for various applications.
- Design various active filters using Op amps.
- Understand various applications of 555 565 and 566 ICs.
- Demonstrate their knowledge by digital circuits.
- Design various combinational circuits using various Digital Integrated IC's.

PART- A

1. Study of OP AMPs – IC 741, IC 555, IC 565, IC 566, IC 1496 – functioning, parameters and Specifications.
2. OP AMP Applications – Adder, Subtractor, Comparator Circuits.
3. Integrator and Differentiator Circuits using IC 741.
4. Active Filter Applications – LPF, HPF (first order)
5. Active Filter Applications – BPF, Band Reject (Wideband).
6. Schmitt Trigger Circuits – using IC 741 and IC 555
7. Function Generator using OP AMPs.
8. IC 555 Timer – Monostable Operation Circuit.
9. IC 555 Timer – Astable Operation Circuit.
10. 4 bit DAC using OP AMP

PART -B

11. 8*1 MULTIPLEXER-74151.
12. 1*8 Demultiplexer-74155.
13. Decade counter using 74LS90

Equipment required for Laboratories:

1. RPS.
2. CRO.
3. Function Generator.
4. Multimeter.
5. IC Trainer Kits (Optional).

6. Bread Boards.
7. Components:- IC741, IC555, IC74151, IC74155, IC74LS90, IC Tester.

Experiments to be conducted beyond the syllabus:

1. IC 741 Oscillator Circuit - Wien Bridge Oscillator
2. IC 741 Oscillator Circuit – Phase Shift Oscillator.

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	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	-	-	2	-	-	-	3	-
CO2	2	3	-	-	2	-	-	-	-	-	2	-	-	-
CO3	-	-	3	-	2	-	3	-	-	3	-	-	3	-
CO4	3	-	2	-	-	-	-	-	3	-	-	-	-	-
CO5	3	-	-	-	-	-	-	3	-	-	-	3	-	-
CO6	-	-	3	-	-	-	-	-	-	-	-	-	3	-

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III Year - I Semester

L T P C
0 0 2 1

DIGITAL COMMUNICATIONS LAB

Practice:	2	**Internal Marks:**	40
Credits:	1	**External Marks:**	60

Prerequisites:

Basics of Communications, Signals & Systems and Probability & Random Processes.

Course Objectives:

- To acquire practical knowledge of digital communication systems.
- To implement different modulation and demodulation techniques.
- To analyze the outputs of various digital modulation techniques.
- To perform and interpret various source coding and error control coding techniques.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the Time-Division Multiplexing systems, and verify the output of pulse code modulation and demodulation.
CO2	Analyze the output of differential pulse code modulation and demodulation and verify the delta modulation.
CO3	Analyze the outputs of different digital modulation techniques-FSK, PSK.
CO4	Interpret the outputs of DPSK modulation and demodulation.
CO5	Analyze the outputs of source encoder and decoder, linear block codes, convolution codes and binary cyclic codes.
CO6	Perform and analyze the output of companding circuit.

List of Experiments:

1. Time division multiplexing.
2. Pulse code modulation.
3. Differential pulse code modulation.
4. Delta modulation.
5. Frequency shift keying.
6. Phase shift keying.
7. Differential phase shift keying.
8. Companding
9. Source Encoder and Decoder
10. Linear Block Code-Encoder and Decoder
11. Binary Cyclic Code – Encoder and Decoder
12. Convolution Code – Encoder and Decoder

Equipment Required:

1. RPS – 0 – 30 V
2. CRO – 0 – 20 M Hz.
3. Function Generators – 0 – 1 M Hz
4. RF Generators – 0 – 1000 M Hz. /0 – 100 M Hz.
5. Multimeters
6. Lab Experimental kits for Digital Communication
7. Components

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2
CO1	2	3	-	-	2	-	-	-	1	-	-	-	-	-
CO2	-	3	2	-	-	-	-	2	-	-	-	-	-	3
CO3	2	-	-	3	-	-	-	-	-	3	-	-	-	3
CO4	2	2	2	-	-	-	3	-	2	-	-	-	-	-
CO5	-	-	-	-	-	3	-	-	-	-	2	-	-	3
CO6	3	-	2	-	3	-	-	-	-	-	-	3	-	-

III Year - I Semester **L T P C**

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0 0 2 1

VHDL PROGRAMMING LAB

Practice:	2	**Internal Marks:**	40
Credits:	1	**External Marks:**	60

Prerequisites:

Switching Theory and Logic Design, C Language, Pulse & Digital Circuits Laboratory

Course Objectives:

- Introduce the basic HDL languages and their importance in digital design.
- VHDL fundamentals were discussed to modelling the digital system design blocks.
- Model digital systems at several levels of abstractions, dataflow, behavioural, structural & mixed signalling modelling.
- Analyse and design basic digital circuits with combinatorial and sequential logic circuits using VHDL.
- VHDL compilers, simulators and synthesis tools are described, which are used to verify digital systems in a technology-independent fashion.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the three different modeling styles of digital circuits.
CO2	Design various combinational circuits using VHDL.
CO3	Develop a VHDL source code for comparators and code converters.
CO4	Perform simulation of various sequential circuits using VHDL.
CO5	Analyze the obtained simulation results.
CO6	Verify the logic with the necessary hardware.

List of Experiments: (Minimum of ten experiments has to be performed)
Note: The students are required to develop VHDL source code, perform simulation using a relevant simulator, and analyze the obtained simulation results using a necessary synthesizer. All the experiments are required to verify and implement the logical operations on the latest FPGA Hardware in the Laboratory.

1. Realization of logic gates using three models.
2. Design of full adder and develop VHDL code using three models.
3. Design 3 to 8 decoders and develop VHDL code.
4. Design 8 to 3 encoder and develop VHDL code.
5. Design 8 x 1 multiplexer and develop VHDL code.
6. Design 4- bit magnitude comparator and develop VHDL code.
7. Design 4-bit binary to grey code converter and develop VHDL code.
8. Design D-flip-flop and develop VHDL code.

9. Design decade counter and develop VHDL code
10. Design universal shift registers and develop VHDL code.
11. Design an 8-bit serial in-parallel out and parallel in-serial out shift register and develop VHDL code.
12. Design ALU and develop VHDL code.

Equipment Required:

1. Xilinx Vivado software / Equivalent Industry Standard Software. 2
2. . Xilinx Hardware / Equivalent hardware.
3. 3. Personal computer system with necessary software to run the programs and implement.

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2
CO1	3	2	-	-	2	-	-	-	1	-	-	-	-	-
CO2	3	2	2	-	-	-	-	2	-	-	-	-	2	3
CO3	3	2	-	3	3	-	-	-	-	3	-	-	-	3
CO4	3	2	2	-	-	-	3	-	2	-	-	-	-	-
CO5	3	2	-	-	-	3	-	-	-	-	2	-	2	3
CO6	3	3	2	-	3	-	-	-	-	-	-	3	-	-

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AUTONOMOUS SYLLABUS

III - II

SEMESTER

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III Year - II Semester **L T P C**
3 1 0 4

VLSI DESIGN

Lecture – Tutorial:	3-1 Hours	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

Prerequisites: Basic electrical properties of MOSFET, CMOS technology, Digital electronics circuits.

Course Objectives:

- Use mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnects.
- Learn the various fabrication steps of IC and come across basic electrical properties of MOSFET.
- Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect and to verify the functionality, timing, power and parasitic effects.
- Understand the design for testability.
- Know the FPGA architecture and design flow, CPLD and system on chip.
- Highlight the circuit design issues in the context of VLSI technology, power calculations and clock mechanism.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the CMOS fabrication flow and also the electrical properties of MOS and Bi-CMOS circuit.
CO2	Know three sets of design rules with which NMOS and CMOS designs may be fabricated.
CO3	Estimate the scaling factors determining the characteristics and performance of MOS circuits in silicon.
CO4	Know about scaling of MOS circuits.
CO5	Understand the concepts of FPGA design, synthesis and different case studies.
CO6	Analyze the design for testability techniques and understand the mixed signal design, classify the power calculations, package selection and clock mechanism.

Course Content(Syllabus)

UNIT I

Introduction : Introduction to IC Technology, MOS and related VLSI Technology, Basic MOS Transistors, Enhancement and Depletion modes of transistor action, IC production process, MOS and CMOS Fabrication processes

Basic Electrical Properties Of MOS and Bi-CMOS Circuits: I_{ds} versus V_{ds} Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit, Alternative forms of pull-up, The CMOS Inverter ,Comparison between CMOS and Bipolar technologies, BiCMOS Technology.

UNIT II

MOS and Bi-CMOS Circuit Design Processes: The NMOS Inverter , Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter. Pass transistor, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter through one or more pass transistors.

MOS and Bi-CMOS Circuit Design Rules: MOS Layers, Realization of gates using NMOS, PMOS and CMOS technologies, Stick Diagrams, Design Rules and Layout, General observations on the lambda based Design rules, 2µm Double Metal, Double Poly, CMOS/BiCMOS rules, 1.2µm Double Metal, Double Poly

CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter.

UNIT III

Basic Circuit Concepts: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, The Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Fan-in and fan-out characteristics, Choice of layers, Switch logic, Gate logic.

Scaling Of MOS Circuits: Scaling models, Scaling factors for device parameters, Limits due to sub threshold currents, current density limits on logic levels and supply voltage due to noise.

UNIT IV

FPGA Design: ASIC design flow, FPGA design flow, Basic FPGA architecture, FPGA Technologies, CPLD, Introduction to SoC design.

VlSI Design Issues: VLSI Design issues and design trends, design process, design for testability, technology options, power calculations, package selection, clock mechanisms, mixed signal design.

TEXT BOOKS:

1. Essentials of VLSI Circuits and Systems By Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, Prentice-Hall of India Private Limited,2005 Edition.
2. VLSI Design-Black Book By Dr. K.V.K.K. Prasad, Kattula Shyamala, Kogent Learning Solutions Inc.2012 Edition.

REFERENCES:

1. VLSI Design By A.Albert Raj & T.Latha,PHI Learning Private Limited,2010.
2. VLSI Design-A.Shanthi and A.Kavita, New Age International Private Limited, 2006 First Edition.

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	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	-	-	-	-	-	-	3	2
CO2	-	-	3	2	-	-	3	-	-	-	-	3	-	-
CO3	3	3	2	-	-	-	-	2	-	-	3	-	3	-
CO4	-	2	-	-	3	-	-	3	-	3	-	-	-	2
CO5	3	2	3	-	-	-	-	-	3	-	-	-	3	-
CO6	2	3	3	-	-	-	-	-	-	-	-	3	-	-

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III Year - II Semester **L T P C**
3 1 0 4

MICROPROCESSORS & MICROCONTROLLERS

Lecture – Tutorial:	3-1 Hours	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

Prerequisites: Digital Electronics, Computer Organization

Course Objectives:

- To familiarize with architecture of 8086 microprocessor and 8051 microcontroller.
- To introduce the assembly language programming concepts of 8086 processor.
- To expose with various interfacing devices with 8086 and 8051.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Gain the knowledge of the architecture and instruction set of 8086 Microprocessor and 8051 micro controller.
CO2	Identify a detailed s/w & h/w structure of the microprocessor and microcontroller.
CO3	Illustrate how the different peripherals are interfaced with 8086.
CO4	Interface various I/O devices to the 8051 microcontroller.
CO5	Develop 8086 and 8051 based different kinds of applications.
CO6	Design various interfacing circuits for computing peripherals

Course Content(Syllabus)

UNIT I

8086 Microprocessor

Introduction to Microprocessor, Features of 8086 Processor, Register Organization of 8086, Architecture, Memory Segmentation, Signal Descriptions of 8086.

Modes of 8086 System

Physical Memory Organization, General Bus Operation, I/O Addressing Capability, Minimum and Maximum Mode 8086 Systems and Timing Diagrams.

UNIT II

Instruction Set and Assembly Language Programming of 8086

Addressing Modes, Instruction Sets, Assembler Directives and Operators, Simple Programs Involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

Stack and Interrupts

Introduction to Stack, Stack Structure of 8086, Interrupts and Interrupt Service Routines, Interrupt Cycle of 8086,Non Maskable Interrupts, Maskable Interrupts, Interrupt Programming.

UNIT III

Basic Peripherals and Interfacing

Semiconductor Memory Interfacing, PIO 8255, Modes of Operations of 8255, Interfacing Analog to Digiatal Data Converters, Interfacing Digital to Analog Converters, Stepper Motor Interfacing.

Programmable Peripheral Devices

Programmable Interrupt Controller 8259A, Programmable Communication Interface 8251 USART, DMA Controller 8257.

UNIT IV

8051 Microcontrollers

Introduction to Microcontrollers, Features of 8051 Controller, Architecture of 8051, Signal Description of 8051, Register Set 0f 8051, Memory Organization, Addressing Modes of 8051, Instruction Set of 8051.

Interfacing with Keyboard/Display Devices

Input/Output Pins Ports and Circuits, Timers and Counters Serial Ports, Interrupt Structure, Interrupt Priority in 8051, LED's, 7 Segment Display Unit, LCD Unit, A/D, D/A and Keyboard Interfacing.

TEXT BOOKS:

1. A. K. Ray and K.M. Bhurchandani, "Advanced Microprocessors and Peripherals", TMH, 2nd edition, 2006
2. Kenneth. J. Ayala, "The 8051 Microcontroller", 3rd Edition, Cengage Learning, 2010.

REFERENCES:

1. D. V. Hall' "Microprocessors and Interfacing", TMH, 2nd edition 2006. .
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, "The 8051 Microcontrollers and Embedded Systems", Pearson, 2nd Edition.
3. Barry B.Brey, "The Intel Microprocessors", PHI, 7th Edition, 2006.

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	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	-	3	-	-	-	2	-	-	-	-
CO2	2	2	-	2	-	-	-	3	-	-	-	-	3	-
CO3	-	3	3	-	2	-	-	-	-	-	3	-	3	-
CO4	3	2	-	2	-	-	-	-	3	-	-	-	-	2
CO5	2	-	-	3	-	-	3	-	-	-	3	2	3	-
CO6	-	2	-	2	-	-	-	-	-	2	-	-	-	-

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III Year - II Semester

L	T	P	C
3	1	0	4

DIGITAL SIGNAL PROCESSING

Lecture – Tutorial:	3-1 Hours	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

Prerequisites: Signals and Systems, Laplace and Fourier Transforms.

Course Objectives:

- Analyze the Discrete Time Signals and Systems
- Know the importance of FFT algorithm for computation of Discrete Fourier Transform
- Understand the various implementations of digital filter structures
- Learn the FIR and IIR Filter design procedures
- Know the need of Multi rate Processing
- Learn the concepts of DSP Processors

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Apply the difference equations concept in the analysis of discrete time systems.
CO2	Understand the FFT algorithm for solving the DFT of a given signal.
CO3	Design a Digital filter (FIR&IIR) from the given specifications.
CO4	Realize the FIR and IIR structures from the designed digital filter.
CO5	Understand the Multirate Processing concepts to be used various applications (eg: Digital filter banks, sub band coding of speech signals).
CO6	Apply the signal processing concepts on DSP Processors.

Course Content(Syllabus)

UNIT I

INTRODUCTION TO DIGITAL SIGNAL PROCESSING: Discrete time signals & sequences, Classification of Discrete time systems, stability of LTI systems, Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems.

DISCRETE FOURIER SERIES AND DISCRETE FOURIER TRANSFORMS: Properties of Discrete Fourier series, DFS representation of periodic sequences. Discrete Fourier Transforms**,** Properties of DFT, linear filtering methods based on DFT.

UNIT II

FAST FOURIER TRANSFORMS: Fast Fourier Transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

REALIZATION OF DIGITAL SYSTEMS: Review of Z-Transforms: Solution of difference equations using Z-transforms, System function. Building blocks of a block diagram, Basic structures of IIR systems, Transposed forms. Basic structures of FIR systems.

UNIT III

DESIGN OF IIR DIGITAL FILTERS:

Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations.

DESIGN OF FIR DIGITAL FILTERS:
Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique, Comparison of IIR & FIR filters.

UNIT IV

MULTIRATE DIGITAL SIGNAL PROCESSING: Introduction, Decimation , Interpolation Sampling rate conversion ,Implementation of sampling rate converters**,** Applications – Sub-band Coding of Speech Signals ,Implementation of Digital Filter Banks, Trans-multiplexers.

INTRODUCTION TO DSP PROCESSORS: Introduction to programmable DSPs: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs, Multiple Access Memory, Multiported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals. Architecture of TMS320C5X: Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals.

TEXT BOOKS:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G.Manolakis, Pearson Education /PHI, 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PHI.
3. Digital Signal Processors – Architecture, Programming and Applications,, B.Venkataramani, M.Bhaskar, TATA McGraw Hill, 2002.
4. Digital Signal Processing – K Raja Rajeswari, I.K. International Publishing House.

REFERENCES:

1. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006.
2. Digital Signal Processing: MH Hayes, Schaum's Outlines, TATA Mc-Graw Hill, 2007.
3. DSP Primer - C. Britton Rorabaugh, Tata McGraw Hill, 2005.
4. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris,Thomson, 2007.
5. Digital Signal Processing – Alan V. Oppenheim, Ronald W. Schafer, PHI Ed., 2006.
6. Digital Signal Processing – P.Ramesh babu, Sci Tech publications.

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2
CO1	2	2	-	2	-	-	-	-	-	-	-	3	-	-
CO2	2	-	-	-	3	-	-	2	-	-	-	-	-	3
CO3	3	3	3	-	-	-	3	-	-	-	2	-	2	-
CO4	3	3	-	2	-	-	-	-	3	-	-	-	3	-
CO5	2	-	3	2	-	3	-	-	-	-	-	-	-	-
CO6	-	2	-	2	-	-	-	3	-	2	-	-	-	3

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III Year - II Semester **L T P C**
3 0 0 3

CELLULAR AND MOBILE COMMUNICATIONS

PROFESSIONAL ELECTIVE – II

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Analog Communications, Digital Communications.

Course Objectives:

- Understand the basic cellular concepts like frequency reuse, cell splitting, cell sectoring etc., and various cellular systems.
- Understand the different types of interferences influencing cellular and mobile communications.
- Understand the concept of propagation model and the different types antennas used at cell site and mobile.
- Understand the frequency management, channel assignment, various propagation effects in cellular environment and the concepts of handoff and types of handoffs.
- Understand the architectures of GSM and 3G cellular systems.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Demonstrate an understanding on cellular communication system, architecture, functioning, various standards and different evolution of cellular communication systems up to 5G.
CO2	Interpret the cellular system operation and design concepts, cell splitting.
CO3	Measure Co-Channel and Non Co-Channel interferences for various mobile radio propagation models and interpret the C/I measurements for different antenna systems.
CO4	Estimate the frequency management, channel assignment, channel sharing and channel borrowing techniques.
CO5	Understand impairments due to multipath fading channel, and designing of different antennas.
CO6	Design the Omni-directional and directional antennas used at cell sites and their synthesis methods.

Course Content(Syllabus)

UNIT I

Introduction to Cellular Mobile Systems: A basic cellular system, Performance criteria, Uniqueness of mobile radio environment: Modal of transmission medium, Mobile fading characteristics, Delay spread and Coherence bandwidth, Operation of Cellular Systems, Hexagonal shaped cells. Evolution of mobile cellular communication: different generations of mobile cellular communication (1G, 2G, 3G, 4G and beyond), 5G vision.

Elements of Cellular Mobile Radio System Design: Concept of frequency reuse channels: Frequency reuse schemes, Frequency reuse distance, Number of customers in the system, Permanent and Dynamic cell splitting, cell sectoring, Cellular structures: macro, micro, pico and femto cells.

UNIT II

Interference: Co-channel Interference at the mobile unit and cell site, Design of an Omni-directional and Directional antenna systems. Non-cochannel Interference: Adjacent channel interference: Next channel interference, Neighboring channel interference, Near-End-Far-End Interference.

Frequency Management: Numbering the channels and grouping into subsets, Frequency spectrum utilization, Setup, access and paging channels, Self-location scheme at the mobile unit.

Channel Assignment: Channel assignments to cell sites and travelling mobile units, Fixed channel assignment: Adjacent-channel assignment, Channel sharing, Channel borrowing and Underlay-overlay cells, Non-fixed channel assignment algorithms.

UNIT III

Cell Coverage for Signal and Traffic: Signal reflections in flat and hilly terrain, obtaining the mobile point-to-point model (Lee Model), Phase difference between direct and ground reflected paths, General formula for mobile radio propagation between two fixed stations over water or flat open area, Land to mobile transmission over water, Foliage loss.

Cell Site and Mobile Antennas: Sum and difference patterns and their synthesis, Antennas at cell site: Omni directional and Directional antennas: Start-up and Abnormal antenna configurations, Space diversity antennas, Umbrella pattern antennas, unique situations of cell site antennas, Mobile antennas: Roof-mounted and Glass-mounted antennas, Mobile high gain antennas, Horizontally oriented and vertically oriented space-diversity antennas.

UNIT IV

Handoff and Dropped calls: Concept of Handoff, Types of handoff: Based on signal strength and based on carrier to interference Ratio, Handoff initiation, Delaying handoff, Forced handoff, Power- difference handoff, mobile assigned handoff , soft and hard handoff, cell site handoff only, Intersystem handoff, Dropped call rates introduction and formula for Dropped call rate.

Digital Cellular Systems: Global system for mobile (GSM): GSM architecture, OSI model of GSM, GSM channels, Multiple Access schemes FDMA, TDMA CDMA, OFDMA, concepts of LTE and LTE-advanced standards, 5G features and challenges.

TEXT BOOKS:

1. Mobile Cellular Telecommunications – W.C.Y. Lee, Tata McGraw Hill, 2rd Edn., 2006.

2. Principles of Mobile Communications–Gordon L.Stuber,Springer International 2nd Edt. 2007.

REFERENCES:

. Wireless Communications – Theodore. S. Rapport, Pearson education, 2nd Edn., 2002.

2. Wireless and Mobile Communications – Lee McGraw Hills, 3rd Edition, 2006.

3. Mobile cellular communication- G.Sasibhushan rao, Pearson Education.

4. Wireless Communication and Networking – Jon W. Mark and Weihua Zhqung, PHI, 2005.

5. Wireless Communication Technology – R. Blake, Thompson Asia Pvt. Ltd., 2004.

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2
CO1	3	-	-	-	-	-	1	-	-	2	-	-	-	3
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	3	1	-	3	-	-	-	2	-	2	2	-
CO4	3	-	2	1	-	-	-	-	-	-	-	1	3	-
CO5	-	2	3	-	2	-	-	-	-	2	1	2	-	-
CO6	-	-	-	-	2	-	2	-	1	-	2	-	-	3

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III Year - II Semester **L T P C**
3 0 0 3

DIGITAL SYTEM DESIGN

PROFESSIONAL ELECTIVE-II

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Digital Logic Design, Digital IC Applications.

Course Objectives:

- To learn advanced digital design concepts.
- To design digital sub-systems using Verilog HDL.
- To learn Memory, CPLDs, FPGAs and ASICs.
- To Design and implementation of combinational and sequential digital logic circuits.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Model complex digital systems at several levels of abstractions, behavioral, structural, simulation, synthesis and rapid system prototyping.
CO2	Have basic understanding of Memory, CPLDs, FPGAs and ASICs.
CO3	Design digital circuits and subsystems using Verilog HDL.
CO4	Analyze and design basic digital circuits with combinatorial and sequential logic circuits using Verilog VHDL.
CO5	Investigate suitable Verilog VHDL program constructs in Digital System Designs.
CO6	Apply various Digital ICs in performance evaluation for the synthesis process.

Course Content(Syllabus)

UNIT-I

Part-A (Verilog HDL-Basics) : Introduction, Overview of Digital Design with Verilog HDL,Hierarchical Modeling Concepts, Basic Concepts, Modules and Ports, Gate Level Modeling, Dataflow Modeling

Part-B (Verilog HDL-Programming): Behavioral Modeling, Tasks and Functions, Useful Modeling Techniques, Timing and Delays, User Defined Primitives, Logic Synthesis with Verilog HDL, Testbenches for verification of HDL models.

UNIT-II

Part-A (Combinational Logic Design-I): Introduction, Combinational-Circuit Analysis, Combinational-Circuit Synthesis, Programmed Minimization Methods, Timing Hazards, Circuit Timing, Decoders, Encoders, Three-State Devices.

Part-B (Combinational Logic Design-II): Multiplexers, Exclusive-OR Gates and Parity Circuits, Comparators, Adders, Subtractors, ALUs, Combinational Multipliers. Design considerations of the above combinational logic circuits.

UNIT-III

Part-A (Sequential Logic Design-I): Bistable Elements, Latches and Flip-Flops, Counters, Shift Registers, Clocked Synchronous State-Machine Analysis and Design, Designing State Machines Using State Diagrams.

Part-B (Sequential Logic Design-II): State-Machine Synthesis Using Transition Lists, State-Machine Design Example, Decomposing State Machines, Feedback Sequential Circuits, Feedback Sequential-Circuit Design.

UNIT-IV

Part-A(Memory and CPLDs): Read-Only Memory, Read/Write Memory, Static RAM, Dynamic RAM, Complex Programmable Logic Devices.

Part-B(FPGAs and ASICs): Field-Programmable Gate Arrays, Types of ASICs, ASIC Design flow, Economics of ASICs.

TEXT BOOKS:

1. John F. Wakerly, *"Digital Design: Principles and Practices"*, 4th edition, Pearson, 2008
2. Samir Palnitkar, *"Verilog HDL: A Guide to Digital Design and Synthesis"*, 2nd edition, Pearson, 2003
3. Enoch O. Hwang, *"Digital Logic and Microprocessor Design with VHDL"*, 1st edition, Nelson Engineering, 2007.

REFERENCE BOOKS:

1.Michael John Sebastian Smith, *"Application-Specific Integrated Circuits"*, 1st edition, Pearson, 2002
2. Charles H. Roth, *"Fundamentals of Logic Design"*, 5th edition, Cengage Learning, 2004
3. Randy H. Katz, Gaetano Borriello, *"Contemporary Logic Design"*, 2nd edition, PHI Learning, 2009

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	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	-	3	-	-	-	-	-	-	-	2	-
CO2	-	3	3	2	-	-	2	2	-	-	-	-	-	3
CO3	2	3	-	3	2	-	-	-	2	-	-	-	3	-
CO4	2	-	3	3	-	-	-	-	-	3	2	-	-	2
CO5	2	3	-	-	-	2	-	2	-	-	-	-	-	-
CO6	-	3	2	-	-	-	-	-	-	-	-	3	3	-

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III Year - II Semester **L T P C**
3 0 0 3

PROFESSIONAL ELECTIVE - II

ELECTROMAGNETIC INTERFERENCE AND ELECTROMAGNETIC COMPATIBILITY

(EMI / EMC)

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: EM Waves & Transmission Lines, Wave Propagation, Antennas.

Course Objectives:

- To familiarize with the fundamentals that are essential for electronics industry in the field of EMI / EMC
- To understand EMI sources and its measurements.
- To understand the various techniques for electromagnetic compatibility.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand natural and nuclear sources of EMI and its practical concerns.
CO2	Learn about electromagnetic emissions from various appliances and circuits.
CO3	Analyze the concept of electromagnetic interference and cross talk in transmission lines.
CO4	Study about various types of radiated and conducted interference measurements.
CO5	Understand about electrostatic discharge and electric surges.
CO6	Learn different types of grounding, shielding and bonding.

Course Content(Syllabus)

UNIT I

Introduction, Natural and Nuclear Sources of EMI / EMC:

Concepts of EMI/EMC and Definitions, Practical experiences and concerns, Natural and Nuclear sources of EMI, Lightning Discharge: Cloud-to-Ground Discharge, Cloud-to-Cloud Discharge, EM field produced by Lightning, Effects of Lightning Discharge on Transmission Lines, Electro Static Discharge: Charge accumulation and discharge, Model MSD waveform, ESD equivalent circuit, Radiated field from ESD.

UNIT II

EMI from Apparatus and Circuits, Open Area Test Sites:

Electromagnetic emissions: Systems, Appliances, Noise from Relays and Switches, Nonlinearities in circuits, Cross talk in transmission lines, Transients in power supply lines, Electromagnetic interference (EMI), Open area test sites measurements: Measurement of RE and RS, Open area test

site: Stationary EUT, Stationary Antenna, EUT-Antenna separation.

UNIT III

Radiated and Conducted Interference Measurements and ESD:

Anechoic chamber, TEM cell, GH TEM Cell, Characterization of conduction currents / voltages (CM & DM interference), Conducted EM noise on power lines, Conducted EMI from equipment, Immunity to conducted EMI detectors and measurements, ESD, Electrical fast transients / bursts, Electrical surges.

UNIT IV

Grounding, Shielding, Bonding and Cables, Connectors, Components:

Principles and types of grounding, Shielding and bonding, Power line filter design: common-mode, differential mode and combined CM and DM filters, EMI suppression cables, EMC connectors, EMC gaskets, Opto-Isolators.

TEXT BOOKS:

1. Engineering Electromagnetic Compatibility - Dr. V.P. Kodali, IEEE Publication, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.
2. Electromagnetic Interference and Compatibility IMPACT series, IIT – Delhi, Modules 1 – 9.

REFERENCES:

1. Introduction to Electromagnetic Compatibility - Ny, John Wiley, 1992, by C.R. Pal.

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2
CO1	3	-	-	3	-	3	-	-	-	-	3	-	-	-
CO2	2	3	-	-	2	-	-	2	-	-	-	-	3	-
CO3	-	-	3	-	2	-	-	-	3	-	-	-		2
CO4	-	3	2	-	-	-	-	-	-	2	-	-	3	-
CO5	3	-	3	-	-	-	-	3	-	-	-	-	-	-
CO6	-	-	3	-	-	-	3	-	-	-	-	-	-	-

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0 0 2 1

VLSI LABORATORY

Lecture – Tutorial:	0-0 Hours	**Internal Marks:**	40
Credits:	1	**External Marks:**	60

Prerequisites: CMOS technology, Digital Electronic Circuits.

Course Objectives:

- Understand the physics and modeling of MOSFET.
- Fabricate steps and layout of CMOS integrated circuits.
- Analyze the performance of CMOS inverter and various circuits.
- Design CMOS circuits using various design rules.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Design CMOS logic circuits.
CO2	Simulate the circuit with tanner EDA tools.
CO3	Apply the design rules to get the layout of the circuits.
CO4	Apply lambda based design rules and solve the problem in the design of CMOS logic circuits.
CO5	Design various gates, adders, encoders and flip-flops.
CO6	Understand various design rules to obtain the CMOS logic circuits.

LAB EXPERIMENTS:

VLSI LABORATORY USING EDA TOOL(SCHEMATIC AND LAYOUT DIAGRAMS)

The students are required to design the schematic diagrams using CMOS logic and to draw the layout diagrams to perform the following experiments using 130nm technology with the Industry standard EDA Tools.

1. Implementation of an inverter using CMOS logic.
2. Implementation of the universal gates using CMOS logic.
3. Implementation XOR gate using CMOS logic.
4. Full Adder using CMOS logic.
5. Full subtractor using CMOS logic.
6. Implementation of SR latch using CMOS logic.
7. Implementation of D latch using CMOS logic.
8. Design of Decoder using CMOS logic.
9. Design of Static RAM cell using CMOS logic.
10. Design of Differential Amplifier using CMOS logic.

Design of flip flop using CMOS logic.

SOFTWARE REQUIRED:

1. Mentor Graphics Software / Equivalent Industry Standard Software.
2. Personal computer system with necessary software to run the programs and to implement.

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	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	-	-	-	-	-	3	-
CO2	-	2	-	2	-	-	-	3	-	2	-	-	-	2
CO3	-	-	3	-	-	2	-	-	2	-	3	3	-	-
CO4	2	-	-	-	-	-	-	-	-	3	-	-	2	-
CO5	-	2	-	2	3	-	2	-	-	-	2	3	-	-
CO6	-	3	-	-	-	-	-	-	-	-		-	3	-

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POTHAVARAPPADU (V), (VIA) NUNNA, AGIRIPALLI (M), PIN – 521 212

III Year - II Semester **L T P C**
0 0 2 1

Microprocessors & Microcontrollers Lab

Lecture – Tutorial:	0-0 Hours	**Internal Marks:**	40
Credits:	1	**External Marks:**	60

Prerequisites: Digital Electronics, Computer Architecture

Course Objectives:

- To develop assembly language program skills and providing the basic knowledge of interfacing various peripherals to 8086 microprocessor and 8051 Microcontroller.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Develop the assembly language Programmers' for 8086 Microprocessor
CO2	Use the cross compiler such as MASM to verify and simulate the 8086 codes
CO3	Interfacing of various peripheral chips to 8086 microprocessor.
CO4	Develop the assembly language Programmes for 8051 Microcontroller.
CO5	Design various interfacing circuits for Real world and practical Applications.
CO6	Analyze the performance of various interface techniques for the computing circuits.

LAB EXPERIMENTS:

PART1:
MICROPROCESSOR 8086
Introduction to
MASM/TASM.

1. Arithmetic Operations - Multi byte addition and subtraction, multiplication and division, signed and unsigned operations, ASCII Arithmetic Operations.
2. Logic operations - shift and rotate, Converting packed BCD to Unpacked BCD, BCD to ASCII conversion.
3. By using string operations and instruction prefix: Move, Block, Reverse string, Sorting, Inserting, Deleting, Length of the string and string comparison.
4. Factorial on a given Number
5. Sum of square and Sum of Cubes of a given number

PART-II: INTERFACING WITH MICROPROCESSOR 8086 (Any 2 Experiments)

1. 8259-Interrupt Controller –Generate interrupt using 8259 timer.
2. 8279-Keyboard Display-write a ALP to display a string of character.
3. 8255-PPI-write ALP to generate sinusoidal wave, triangular and saw tooth wave using PPI.
4. 8251 USART Write ALP to establish communication between two processors.

PART-III: MICROCONTROLLER 8051

1. Switches and LEDs.
2. Traffic light Controller.
3. Finding No of 1's and 0's in a given 8 bit number
4. Addition of even number from a given array
5. Serial Communication

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Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	-	2	-	-	-	-	-	3	-	-	-	3
CO2	-	3	-	2	-	-	-	-	-	2	-	-	-	2
CO3	3	-	3	-	3	-	-	-	-	-	2	-	-	-
CO4	-	3	3	-	-	2	-	-	2	-	-	-	2	3
CO5	2	-	-	-	-	-	3	-	-	-	-	-	-	-
CO6	-	2	-	2	-	-	-	3	-	2	-	-	3	-

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III Year - II Semester **L T P C**
0 0 2 1

Digital Signal Processing Laboratory

Lecture – Tutorial:	0-0 Hours	**Internal Marks:**	40
Credits:	1	**External Marks:**	60

Prerequisites: Signals and Systems, Laplace and Fourier Transforms.

Course Objectives:

- Analyze the Discrete Time Signals and Systems
- Know the importance of FFT algorithm for computation of Discrete Fourier Transform
- Understand the various implementations of digital filter structures
- Learn the FIR and IIR Filter design procedures
- Learn the concepts of DSP Processors

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Apply the difference equations concept in the analysis of discrete time systems.
CO2	Understand the FFT algorithm for solving the DFT of a given signal.
CO3	Design a Digital filter (FIR&IIR) from the given specifications.
CO4	Realize the FIR and IIR structures from the designed digital filter.
CO5	Understand the Multirate Processing concepts to be used various applications (eg: Digital filter banks, sub band coding of speech signals).
CO6	Apply the signal processing concepts on DSP Processors.

LIST OF EXPERIMENTS:

All the Following Experiments should be conducted using MATLAB software.

1. Generation of Discrete time signals.
2. Computation of Linear Convolution.
3. Computation of Circular Convolution.
4. Addition of Sinusoidal signals.
5. Computation of DFT and IDFT.
6. Frequency response of IIR low pass and high pass Butterworth filter.
7. Frequency response of IIR low pass and high pass Chebyshev filter.
8. Frequency response of FIR low pass and high pass filter using Rectangular window.
9. Frequency response of FIR low pass and high pass filter using Triangular window.
10. Computation of N-Point FFT.

<u>Experiments to be conducted beyond the syllabus</u>

1. Implementation of Decimation and Interpolation for a Sequence/Signal.

2. Verification of Linear Convolution and Circular Convolution of sequences using Code Composer Studio (CCS).

SOFTWARE REQUIRED:

1. MATLAB software

Contribution of Course Outcomes towards achievement of Program Outcomes (POs) and Program Specific outcomes (PSOs) (1 – Low, 2- Medium, 3 – High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PSO 2
CO1	3	2	-	2	-	3	-	-	-	-	-	3	-	3
CO2	-	-	-	-	3	-	-	2	-	3	-	-	-	3
CO3	3	3	3	-	-	-	3	-	-	-	2	-	2	-
CO4	2	3	-	-	-	-	-	-	-3	-	-	-	3	-
CO5	2	-	3	2	3	3	-	-	-	-	-	-	-	2
CO6	-	2	-	2	-	-	-	3	-	2	-	-	3	-

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

COURSE STRUCTURE FOR FINAL YEAR B.TECH PROGRAMME-NRIA 18

IV YEAR I SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	PC	Microwave Engineering	3	1	-	4	40	60	100	4
2	PC	Optical Communication	3	-	-	3	40	60	100	3
3	PC	Digital Image Processing	3	1	-	4	40	60	100	4
4	PE	**Professional Elective III** **(i)**Satellite Communications & RADAR Engineering **(ii)** Data Base Management Systems **(iii)** Embedded System Design	3	-	-	3	40	60	100	3
5	PE	**Professional Elective IV** **(i)** Data Communications **(ii)** Operating Systems **(iii)** Analog IC Design	3	-	-	3	40	60	100	3
6	MC	***Indian Constitution (MC)***	2	-	-	2	40	60	100	0
7	PC	Microwave Engineering & OC Lab	-	-	2	2	40	60	100	1
8	PR	Mini Project	-	-	8	8	40	60	100	4
Total			**17**	**2**	**10**	**29**	**320**	**480**	**800**	**22**

IV YEAR II SEMESTER

Sl. No	Course Code	Title of the Course	Scheme of Instruction (Periods Per Week)				Scheme of Examination (Maximum Marks)			No. of Credits
			L	T	P	Total	CIA	SEA	Total	
1	PE	**Professional Elective V (MOOCS)** **(i)**Wireless Communications and Networks **(ii)** Soft Computing Techniques **(iii)** Digital IC Design	3	-	-	3	40	60	100	3
2	PE	**Professional Elective VI (MOOCS)** **(i)** Computer Networks **(ii)** Internet of Things and Applications	3	-	-	3	40	60	100	3

		(iii) Artificial Intelligence								
3	**PR**	Main Project and Seminar	**-**	**-**	16	16	80	120	200	8
		Total	**6**	**-**	**16**	**22**	**160**	**240**	**400**	**14**

IV Year - I Semester **L T P C**
3 1 0 4

Microwave Engineering

Lecture – Tutorial:	3-1 Hours	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

Prerequisites: Transmission Lines, Electromagnetic Field Theory

Course Objectives:

- To understand the structure, and function of the various microwave tubes as oscillators and Amplifiers.
- To learn about Microwave solid State Devices as oscillators.
- To analyze fundamental characteristics of Micro strip lines through electromagnetic field concepts.
- To understand the basic properties of waveguide components, Ferrite materials and Microwave Bench Setup for measurement of Microwave parameters.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Describe the modes of operation of Klystron tube as microwave Oscillator and amplifier with calculation of efficiency.
CO2	Analyze the modes of operation of Magnetron and TWT as microwave tubes.
CO3	Explore different modes of propagation in waveguide structures using EM field concepts.
CO4	Understand fundamental characteristics of Micro strip lines through electromagnetic field analysis.
CO5	Estimate the S-matrix for various waveguide components and analyze the splitting of the microwave energy in a desired direction.
CO6	Understand the operation of microwave Solid state devices and Measure various microwave parameters using a Microwave test bench.

Course Content(Syllabus)

UNIT I

Part-A: (O type Microwave Tubes-1)

Introduction, Microwave Spectrum and Bands, Applications of Microwaves. Microwave tubes –

O type and M type classifications. O-type tubes : Two Cavity Klystron– Structure, Principle of working ,Velocity Modulation Process and Applegate Diagram, Expressions for o/p Power and Efficiency, Applications.

Part-B: (O type Microwave Tubes-2)

Reflex Klystron – Structure, Principle of working, Velocity Modulation Process and Applegate Diagram, Mathematical Theory of Bunching, Power Output, Efficiency, Oscillating Modes, Applications.

UNIT II

Part-A: (Microwave Tubes-M type)

M-type Tubes Introduction, Magnetrons – Different Types, 8-Cavity Cylindrical Magnetron, Hull Cut-off Condition, and PI-Mode Operation. Slow Wave Structures-types, Structure of TWT, working of TWT amplifier, Applications.

Part-B: (Microwave Solid State Devices)

Microwave Solid State Devices: Introduction, Classification, Applications. TEDs – Introduction, Gunn Diode – Principle, Characteristics, Basic Modes of Operation. Avalanche Transit Time Devices

– Introduction, IMPATT and TRAPATT Diodes – Principle of Operation and Characteristics.

UNIT III

Part-A: (Wave Guides)

Rectangular Waveguides – TE/TM modes, Expressions for Fields, Cut-off Frequencies, Filter Characteristics, Mode Characteristics. Circular Waveguides- Introduction, TE/TM modes, Expressions for Fields, Impossibility of TEM Waves in Hollow Waveguides.

Part-B: (Micro strip Lines)

Introduction to Strip Lines, Basic Structure of Micro strip lines, Z_o Relations, Effective Dielectric Constant, advantages of micro strip lines, losses and applications of micro strip lines.

UNIT IV

Part-A: (Wave Guide Components)

Scattering Matrix– Significance, Formulation and Properties. S-Matrix Calculations for - E-plane and H-plane Tees, Magic Tee, Directional Couplers – 2Hole, Ferrite Components–Faraday Rotation, S-Matrix Calculations for Isolator, Circulator, Related Problems.

Part-B: (Microwave Measurements)

Description of Microwave Bench – Different Blocks and their Features, Precautions; Microwave Power Measurement – Bolometer Method, Measurement of Attenuation, Frequency, Guide Wavelength, VSWR.

TEXT BOOKS:

1. Microwave Devices and Circuits – Samuel Y. Liao, PHI, 3rd Edition,1994

2.Microwave Principles – Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, CBS Publishers and Distributors, New Delhi,

REFERENCES:

1. Foundations for Microwave Engineering – R.E. Collin, IEEE Press, John Wiley, 2nd Edition, 2002.
2. Microwave Engineering - David M. Pozar,Wiley publications,4th Edition
3. Microwave Engineering- Annapurna Das and Sisir K.Das, Mc Graw Hill Education, 3rd Edition.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PS O2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	3
CO2	2	2	-	2	-	3	-	-	-	-	-	-	2	-
CO3	3	3	-	-	3	-	-	-	3	-	2	-	-	-
CO4	3	3	-	2	-	-	-	-	-	-	-	-	-	3
CO5	2	2	-		-	-	2	-	-	-	-	2	-	--
CO6	-	2	-	2	-	-	-	-	-	2	-	-	-	3

IV Year - I Semester **L T P C**
3 0 0 3

OPTICAL COMMUNICATION

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Engineering physics, Analog Communications, Digital Communication.

Course Objectives:

- Analyze and design optical communication and fiber optic sensor systems.
- Understand the properties of optical fiber that affect the performance of a communication link and types of fiber materials with their properties and the losses occur in fibers.
- Analyze the principles of single and multi-mode optical fibers and their characteristics.
- Working of semiconductor lasers, differentiate between direct modulation and external electro-optic modulation. Analyze the operation of LEDs, laser diodes, PIN, photo detectors (spectral properties, bandwidth, and circuits) and apply in optical systems.
- Design the functionality of each of the components that comprise a fiber optic communication system, the models of analog and digital receivers.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the overview of optical fiber communication and classify the types of optical fibers, analyze cylindrical fibers using mathematical equations.
CO2	Design the optical fibers using various materials and to illustrate various attenuation losses.
CO3	Illustrate various dispersion models Apply splicing techniques on fibers and choose low loss connectors to minimize joint losses.
CO4	Analyze different types of optical sources and photo detectors, External quantum efficiency, and analyze signal transmission, receiver operation and error sources of optical fiber.
CO5	Evaluate the power coupled in to optical fibres and Measurement of Attenuation and Dispersion, Eye pattern.
CO6	Design optical system with budget analysis and to classify principles and types of WDM.

Course Content(Syllabus)

UNIT I

PART A: Overview of optical fiber communication – Historical development, The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays, Cylindrical fibers- Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers, Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index, Related problems.

PART B: Fiber materials– Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers. **Fiber losses**-Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses

UNIT II

PART A: Signal distortion in optical fibers - Information capacity determination, Group delay, Types of Dispersion-Material dispersion, Wave-guide dispersion, Polarization-Mode dispersion, Intermodal dispersion, related problems.

PART B: Optical fiber Connectors-Connector types, Single mode fiber connectors, Connector return loss, **Fiber Splicing**- Splicing techniques, Splicing single mode fibers, **Fiber alignment and**

joint loss- Multimode fiber joints, single mode fiber joints.

UNIT III

PART A: Optical sources - LEDs, Structures, Materials, Internal and External Quantum efficiency, Modulation, Power bandwidth product. **Laser Diodes**- Fabry perot resonator cavity Laser diode, Distributed feedback (DFB) Laser diode, Reliability of LED & ILD

PART B: Optical detectors - Physical principles of PIN and APD, Comparison of Photo detectors. Photo detector Noise, related problems **Optical receiver operation**- Digital signal transmission through optical data link, error sources in optical pulse detection mechanism, Receiver configuration, Digital receiver performance

UNIT IV

PART A: Source to fiber power launching – Source Output pattern, Power coupling calculations, Power launching versus wavelength, Equilibrium Numerical Aperture, Lansing schemes for coupling improvement, Measurement of Attenuation and Dispersion in optical fibers, Eye pattern.

PART B: Optical system design – Point-to- point links- Component choice and considerations, Link power budget with examples, Rise time budget with examples, Line coding in Optical links, Wavelength Division Multiplexing

TEXT BOOKS:

1. Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition, 3rd Edition, 2000.
2. Optical Fiber Communications – John M. Senior, PHI, 2nd Edition, 2002.

REFERENCES:

1. Fiber Optic Communications: D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education, 2005.
2. Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.
3. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Edition, 2004.
4. Fiber Optic Communications – Joseph C. Palais, 4th Edition, Pearson Education, 2004.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PS O2
CO1	3	3	-	-	-	-	-	-	2	-	-	3	-	-
CO2	-	2	3	-	-	3	-	-	-	-	2	-	-	**3**
CO3	3	-	3	-	3	-	3	-	-	3	-	-	-	-
CO4	-	2	-	-	2	-	-	-	-	-	-	3	-	**2**
CO5	-	-	2	3	-	-	-	2	-	-	-	-	**3**	-
CO6	2	-	2	3	-	-	-	-	-	2	-	-	-	-

IV Year - I Semester **L T P C**
3 1 0 4

DIGITAL IMAGE PROCESSING

Lecture – Tutorial:	3-1 Hours	**Internal Marks:**	40
Credits:	4	**External Marks:**	60

Prerequisites: Mathematics I & II, Engineering Physics, Linear integrated circuits, Signals and Systems, Analog Communications, Digital Signal Processing.

Course Objectives:

- To introduce the concepts of image processing and basic analytical methods to be used in image processing.
- To familiarize students with image enhancement.
- To introduce different image restoration techniques.
- To introduce the concepts of colour image processing.
- To familiarize the students with image compression techniques.
- To introduce morphological processing and segmentation techniques.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the fundamentals of image processing, necessity for transforms, DFT and its properties, DCT.
CO2	Evaluate techniques for image enhancement.
CO3	Estimate the degradation of an image and apply appropriate restoration techniques.
CO4	Understand the need for colour image processing and learn the fundamentals of colour image processing.
CO5	Understand the need for image compression and learn different techniques to compress image.
CO6	Interpret morphological processing and implement different techniques to segment an image.

Course Content(Syllabus)

UNIT I

PART A: Introduction: Introduction to digital image processing, Fundamental steps in digital image processing, components of an image processing system, Image sensing and acquisition, Representing digital images, Some basic relationships between pixels, An introduction to the mathematical tools used in digital image processing.

PART B: Image transforms and Intensity transformations : Need for transforms, DFT with one variable and two variables, Properties of 2D Discrete Fourier transform, Discrete cosine transform, Basics of intensity transformations and spatial filtering, Some basic intensity transformation functions, Histogram processing.

UNIT II

PART A: Filtering in spatial and frequency domain: Fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters Image smoothing and sharpening using frequency domain filters, Selective filtering in frequency domain filters.

PART B: Image Restoration: A model of the image degradation / Restoration process, Restoration in the presence of noise only Spatial Filtering, Periodic Noise Reduction by

frequency domain filtering, Linear, Position –Invariant Degradations, Estimation the degradation function, Inverse filtering, Minimum mean square error(Wiener) filtering.

UNIT III

PART A: Color image processing: Color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color.

PART B: Image compression: Fundamentals, Basic compression methods: Huffman coding, Arithmetic coding, LZW coding, Run-Length coding, symbol based coding, Predictive coding , Wavelet coding, color image compression.

UNIT IV

PART A: Morphological Image Processing: Preliminaries, Erosion and dilation, opening and closing, The Hit or miss transformation, Some basic morphological algorithms, Gray scale morphology, Some basic gray scale morphological algorithms.

PART B: Image segmentation: Fundamentals, point, line, edge detection, Basic edge detection, thresholding, region –based segmentation.

TEXT BOOKS:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar," Digital Image Processing", Tata McGraw-Hill Education, 2011.

REFERENCES:

1. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. B.Chanda, D.Dutta Majumder, "Digital Image Processing and Analysis", PHI, 2009.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PS O2
CO1	3	2	-	-	-	-	3	-	-	-	-	-	-	-
CO2	3	2	-	2	2	-	-	-	-	-	-	-	-	3
CO3	-	3	2	-	-	3	-	-	-	-	-	-	3	-
CO4	3	2	-	3	-	-	-	3	1	-	-	-	-	-
CO5	-	3	2	-	-	-	-	-	-	2	-	-	3	-
CO6	-	2	-	3	2	-	-	-	-	3	-	-	-	-

IV Year - I Semester **L T P C**

3 0 0 3

PROFESSIONAL ELECTIVE – III
SATELLITE COMMUNICATIONS & RADAR ENGINEERING

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Digital Communication, Cellular mobile Communication, Optical communication, Signals and Systems, Analog Communications, Electromagnetic Theory, Antennas and Wave Propagation.

Course Objectives:

- To understand the basic concepts, applications, frequencies used and types of satellite communications.
- To analyze various satellite subsystems and their functionality.
- To familiarize with the concepts of satellite link design and calculation of C/N ratio.
- To understand the concepts of satellite navigation, architecture and applications of GPS.
- To gain knowledge about the basics of RADAR and its parameters.
- To learn about different types of Radars and their applications.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the concepts of satellite communications and to analyze the orbital mechanics and launching vehicles.
CO2	Acquire knowledge about various satellite subsystems and basic transmission theory.
CO3	Understand the basic concepts of satellite uplink and downlink design and to analyze the principles of satellite navigation and Global positioning system.
CO4	Acquire the knowledge of Radar system to apply and to design required parameters for a RADAR system and to derive the RADAR Equation.
CO5	Analyze the working principle of CW and Frequency Modulated Radar and their applications.
CO6	Analyze different types of tracking RADARs and to study different types of Radar receivers and displays.

Course Content(Syllabus)

UNIT I

PART A: Introduction: Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications, Future Trends of Satellite Communications.

PART B: Orbital Mechanics And Launchers: Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance.

UNIT II

PART A: Satellite Subsystems: Attitude and orbit control system, telemetry, tracking, Command and Monitoring, power systems, communication subsystems, Satellite antenna Equipment reliability and Space Qualification.

PART B: Satellite Link Design: Basic transmission theory, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N.
Satellite Navigation and Global positioning system- Radio and Satellite Navigation, GPS Position Location principles, GPS Receivers and codes, GPS Navigation Message, GPS signal

levels, GPS receiver operation, Differential GPS.

UNIT III

PART A: Introduction to Radar: Introduction, Maximum Unambiguous Range, simple Radar range Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Illustrative Problems.

PART B: CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, FM-CW Altimeter, Illustrative Problems.

UNIT IV

PART A: Introduction to MTI Radar: Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, **Tracking with Radar**- Sequential Lobing, Conical Scan, Mono pulse Tracking Radar – Amplitude Comparison Mono pulse (one- and two-coordinates).

PART B: Radar Receivers: Displays – types. Duplexers – Branch type and Balanced type, Circulators as Duplexers.

TEXT BOOKS:

1.Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.

2. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G. Suyderhoud, 2nd Edition, Pearson Publications, 2003.

3. Introduction to Radar Systems – Merrill I. Skolnik, TMH Special Indian Edition, 2nd Ed., 2007.

4. Radar Engineering and fundamentals of Navigational Aids-G.S.N.Raju,I.K International, 2008.

REFERENCES:

1. Satellite Communications: Design Principles – M. Richharia, BS Publications, 2nd Edition, 2003.

2. Satellite Communications – Dennis Roddy, McGraw Hill, 2nd Edition, 1996.

3. Satellite Communication – D.C. Agarwal,Khanna Publications,5th edition.

4. J.C.Toomay, Paul J. Hannen "Principles of Radar", PHI Learning.

5. Radar: Principles, Technology, Applications – Byron Edde, Pearson Education, 2004.

6. Radar Principles – Peebles, Jr., P.Z., Wiley, New York, 1998.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PSO2
CO1	3	2	-	-	3	-	-	-	-	-	-	-	2	-
CO2	-	3	2	-	-	2	-	-	-	-	-	-	-	-
CO3	3	2	-	3	-	-	-	-	3	-	-	2	-	2
CO4	-	3	-	2	-	-	-	-	-	-	2	-	-	2
CO5	3	2	3	-	-	-	-	-	-	-	-	2	-	-
CO6	2	3	-	-	-	-	2	-	-	-	-	-	-	3

IV Year - I Semester **L T P C**
3 0 0 3

PROFESSIONAL ELECTIVE - III

DATABASE MANAGEMENT SYSTEMS

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Fundamental knowledge on C, C++, SQL and basic functions of database systems.

Course Objectives:

- To learn the principles of systematically designing and using large scale Database Management Systems for various applications.
- To understand query processing and techniques involved in query optimization.
- To understand the principles of storage structure and recovery management.
- To understand the concepts of transaction management and concurrency control.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Describe a relational database and object-oriented database.
CO2	Create, maintain and manipulate a relational database using SQL.
CO3	Describe ER model and normalization for database design.
CO4	Examine issues in data storage and query processing and can formulate appropriate solutions.
CO5	Understand the role and issues in management of data such as efficiency, privacy, security, ethical responsibility, and strategic advantage.
CO6	Design and build database system for a given real world problem.

UNIT I

PART A: An Overview of Database Management: Introduction- What is Database System- What is Database-Why Database- Data Independence- Relation Systems and Others- Summary.

PART B: Database system architecture, Introduction: The Three Levels of Architecture-The External Level- the Conceptual Level- the Internal Level- Mapping- the Database Administrator- The Database Management Systems- Client/Server Architecture.

UNIT II

PART A: The E/R Models: The Relational Model, Relational Calculus, Introduction to Database Design, Database Design and Er Diagrams-Entities Attributes, and Entity Sets-Relationship and Relationship Sets-Conceptual Design With the Er Models, The Relational Model Integrity Constraints Over Relations.

PART B: Key Constraints: Foreign Key Constraints-General Constraints, Relational Algebra and Calculus, Relational Algebra- Selection and Projection- Set Operation,
Renaming – Joins- Division- More Examples of Queries, Relational Calculus, Tuple Relational Calculus- Domain Relational Calculus.

UNIT III

PART A: Queries, Constraints, Triggers: The Form of Basic SQL Query, Union, Intersect, and Except, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Database.

PART B: Transaction Management and Concurrency Control: Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and

save point, Concurrency control for lost updates, uncommitted data, inconsistent retrievals and the Scheduler.

UNIT IV

PART A: Concurrency control with locking methods : lock granularity, lock types, two phase Locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering: Wait/Die and Wound/Wait Schemes, Database Recovery management: Transaction recovery.

PART B: Overview of Storages and Indexing: Data on External Storage- File Organization and Indexing –Clustered Indexing – Primary and Secondary Indexes, Index Data Structures, Hash-Based Indexing – Tree-Based Indexing, Comparison of File Organization.

TEXT BOOKS:

1. Introduction to Database Systems, CJ Date, Pearson.
2. Data base Management Systems, Raghurama Krishnan, Johannes Gherkin, TATA McGraw Hill 3rd Edition
3. Database Systems - The Complete Book, H G Molina, J D Ullman, J Widom Pearson

REFERENCE BOOKS:

1. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate Pearson Education.
3. Introduction to Database Systems, C.J.Date Pearson Education.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PSO2
CO1	3	-	-	-	-	-	-	-	-	2	-	-	-	-
CO2	2	3	-	-	2	-	-	-	-	-	3	-	-	-
CO3	-	-	3	-	2	-	-	-	3	-	-	-	3	-
CO4	3	-	3	-	-	-	-	2	-	-	-	-	2	-
CO5	3	-	2	-	-	2	-	-	-	-	-	-	-	-
CO6	-	-	3	-	-	-	-	-	-	-	-	2	-	-

IV Year - I Semester **L T P C**
3 0 0 3

PROFESSIONAL ELECTIVE - III

EMBEDDED SYSTEM DESIGN

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Operating Systems, Microcontrollers, C Programming.

Course Objectives:

- Provide in-depth knowledge about embedded systems embedded processors, and its hardware and software.
- Explain design metrics or challenges in designing an embedded system.
- Explain real time operating systems, inter task communication and an embedded software development tools.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Analyze the differences between general computing system and the embedded systems, also recognize the classification of embedded systems, core of the embedded systems and need for communication interfaces.
CO2	Understand design approaches of embedded hardware and firmware.
CO3	Know about RTOS, RTOS principles, kernel, tasks, threads, multitasking and multiprocessing.
CO4	Understand kernel objects; inter task communication-pipes, signals, message queues, dead lock, and live lock.
CO5	Apply embedded software development tools, understand unique design problems and challenges of real time systems.
CO6	Understand ARM processor architecture and register organization of ARM.

Course Content(Syllabus)

UNIT I

PART A: INTRODUCTION TO EMBEDDED SYSTEMS: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

PART B: TYPICAL EMBEDDED SYSTEM: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Memory: ROM, RAM, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

UNIT II

PART A: EMBEDDED HARDWARE DESIGN: Analog and digital electronic components, I/O types and examples, Timer and counting devices, Watchdog timer, Real time clock.

PART B: EMBEDDED FIRMWARE DESIGN: Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

UNIT III

PART A: REAL TIME OPERATING SYSTEM: Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling, Task communication, Task synchronisation.

PART B: HARDWARE SOFTWARE CO-DESIGN: Fundamental Issues in Hardware Software Co-Design, Computational models in embedded design, Hardware software Trade-offs.

UNIT IV

PART A: Embedded System Development And Testing: The integrated development environment, Types of files generated on cross-compilation, Simulators, Emulators and Debugging, Target hardware debugging, testing on host machine, Embedded Software development process.

PART B: Advanced RISC Machine: Features of ARM, Architecture of ARM, Modes of ARM, Register Organization of ARM, CPSR, Instruction set, Exception handling in ARM, ARM Families.

TEXT BOOKS:

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu.K.V-Tata McGraw Hill Education Private Limited, 2013.
3. Embedded Systems-By Shibu.K.V-Tata McGraw Hill Education Private Limited, 2013.
4.ARM System on Chip Architecture – Steve Furber –2nd Eed., 2000, Addison Wesley Professional

REFERENCES:

1. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
2.Embedded Systems-Lila Beda's-Pearson Publications, 2013

SWAYAM/NPTEL/MOOCS Courses

1. https://nptel.ac.in/courses/108/102/108102045/
2. https://nptel.ac.in/courses/106105193/

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PS O2
CO1	2	3	-	-	-	-	-	-	-	2	-	-	3	-
CO2	-	-	3	-	2	-	-	3	-	-	-	-	-	3
CO3	2	-	-	3	3	-	1	-	-	-	-	3	-	-
CO4	-	2	2	-	-	-	-	-	-	-	-	-	3	2
CO5	3	-	-	-	-	2	-	-	-	-	-	-	3	-
CO6	-	3	-	2	2	-	-	-	2	-	-	-	--	-

IV Year - I Semester **L T P C**
3 0 0 3

PROFESSIONAL ELECTIVE-IV
DATA COMMUNICATIONS

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Analog Communication, Digital Communication.

Course Objectives:

- To learn about basics of Data Communication networks, different protocols, standards and layering concepts.
- To know circuits for serial and parallel Data transmission.
- To study about error detection and correction techniques.
- To describe character synchronization and explain the differences between asynchronous and synchronous data formats.
- To understand Data-Link Protocols and Data Communications Networks,
- Define and describe the Congestion Control and Quality of Service in Data communication traffic control.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the concepts of Data Communication networks, different protocols, Standards and layering.
CO2	Analyze open systems interconnection model and various Data Communication circuits.
CO3	Explore the error investigation techniques in data transmission process.
CO4	Demonstrate the character synchronization and explain the differences between asynchronous and synchronous data formats.
CO5	Analyze different Data-Link Protocols and Data Communications Networks.
CO6	Elaborate the Congestion control and Quality of Service in Data traffic control.

Course Content(Syllabus)

UNIT I

Data Communications and Networking:

Part-A: Introduction, Data Communications Network Architecture, Data Communications Protocols, and Standards, Layered Network Architecture, Protocol data unit.

Part-B: Open Systems Interconnection, Data Communications Circuits, Serial and Parallel Data Transmission, Data Communications Circuit Arrangements, Circuit configurations, Transmission modes, Data Communications Networks, components, functions, features, network models.

UNIT II

Fundamental Concepts of Data Communications:

Part-A: Introduction, Error Control, Error Detection, redundancy checking, Error Correction, retransmission, Forward error correction, hamming code, examples.

Part-B: Character Synchronization, Asynchronous serial data, synchronous serial data, Data

Communications Circuits, Data Communications Modems, block diagram, modem classifications, Asynchronous and synchronous voice band modems.

UNIT III

Data-Link Protocols and Data Communications Networks

Part-A: Introduction, Data-Link Protocol Functions, Line discipline, flow control, error control, Character- and Bit-Oriented Data-Link Protocols, Asynchronous Data-Link Protocols, X-modem, Y-modem Synchronous Data-Link Protocols, binary synchronous communications.

Part-B : Synchronous Data-Link Control, Frame format, loop operation, message abort, Invert on zero encoding, High-Level Data-Link Control, subdivisions, information field, elements of procedure.

UNIT IV

Congestion Control and Quality of Service (QoS)

Part-A: Data traffic, congestion, congestion control-open loop and closed loop, congestion control in TCP and congestion control in frame relay.

Part-B: Flow Characterization, Flow Classes, Need For QoS, Techniques to improve QoS, scheduling, traffic shaping, resource reservation and admission control, integrated and differentiated Services.

TEXT BOOKS:

1. Advanced Electronic Communication Systems – W.Tomasi, 6th ed. 2014, PEI.
2. Data Communications and Networking – B.A.Forouzan, 4th ed.2008, TMH.
3. Data Communications and Computer Nerworks – Prakash C.Gupta, 2006, PHI.

REFERENCES:

1 Data and Computer Communications – William Stallings, 8th ed.2007, PHI
2. Computer Networks by Andrew S. Tanenbaum

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PS O2
CO1	3	-	2	-	-	-	-	-	-	-	-	2	-	-
CO2	-	3	3	-	-	-	2	2	-	-	-	-	-	-
CO3	2	3	-	3	-	-	-	-	-	-	-	-	-	3
CO4	2	-	3	-	-	-	-	-	-	-	2	-	-	2
CO5	-	3	2	-	-	2	-	2	-	-	-	-	3	
CO6	3	2	2		-	-	-	-	-	-	-	-	-	3

IV Year - I Semester **L T P C**
3 0 0 3

PROFESSIONAL ELECTIVE-IV
OPERATING SYSTEMS

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Basic Hardware and Software concepts of Computer Systems and Organization.

Course Objectives:

- Study the basic concepts and functions of operating systems.
- Understand the structure and functions of OS.
- Learn about Processes, Threads and Scheduling algorithms.
- Understand the principles of concurrency and Deadlocks.
- Learn various memory management schemes.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Design various Scheduling algorithms.
CO2	Apply the principles of concurrency.
CO3	Design deadlock, prevention and avoidance algorithms.
CO4	Compare and contrast various memory management schemes.
CO5	Design and Implement a prototype file systems.
CO6	Perform administrative tasks on Servers.

Course Content(Syllabus)

UNIT I

PART A: Introduction to Operating System Concept: Types of operating systems, operating systems Concepts, operating systems services, Introduction to System call, System call types.

PART B: Process Management – Process concept, The process, Process State Diagram , Process control block, Process Scheduling- Scheduling Queues, Schedulers, Operations on Processes, Interprocess Communication, Threading Issues, Scheduling-Basic Concepts, Scheduling Criteria, Scheduling Algorithms.

UNIT II

PART A: Memory Management: Swapping, Contiguous Memory Allocation, Paging, structure of the Page Table, Segmentation.

PART B: Virtual Memory Management:
Virtual Memory, Demand Paging, Page-Replacement Algorithms, Thrashing.

UNIT III

PART A: Concurrency: Process Synchronization, The Critical- Section Problem, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Synchronization Examples.

PART B: Principles of deadlock – System Model, Deadlock Characterization, Deadlock Prevention,
Detection and Avoidance, Recovery form Deadlock

UNIT IV

PART A: File system Interface- the concept of a file, Access Methods, Directory structure, File system mounting, file sharing, protection.

PART B: File System implementation- File system structure, allocation methods, free-space management
Mass-storage structure overview of Mass-storage structure, Disk scheduling, Device drivers.

TEXT BOOKS:

1.Operating System Concepts, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne 9th Edition, John Wiley and Sons Inc., 2012.
2. Operating Systems – Internals and Design Principles, William Stallings, 7th Edition, Prentice Hall, 2011.
3. Operating Systems-S Halder, Alex A Aravind Pearson Education Second Edition 2016.

REFERENCES:

1. Modern Operating Systems, Andrew S. Tanenbaum, Second Edition, Addison Wesley, 2001.
2. Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata Mc Graw Hill Education", 1996.
3. Operating Systems: A Concept-Based Approach, D M Dhamdhere, Second Edition, Tata Mc Graw-Hill Education, 2007.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PS O2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	2	-	-	2	-	-	-	-	-	-	-	2
CO3	2	-	-	3	-	-	-	-	-	-	-	2	-	-
CO4	-	2	-	2	-3	-	-	-	-	-	-	-	-	-
CO5	2	-	3	-	-	-	-	-	-	-	-	2	3	-
CO6	-	3	2	-	-	-	-	-	-	-	-	-	-	-

IV Year - I Semester **L T P C**
3 0 0 3

PROFESSIONAL ELECTIVE-IV
ANALOG IC DESIGN

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Electronic Devices and circuits, Linear IC Applications.

Course Objectives:

Understand the behavior of MOS Devices and Small-Signal & Large-Signal Modeling of MOS Transistor and Analog Sub-Circuits.

Study CMOS Amplifiers like Differential Amplifiers, Cascade Amplifiers, Output Amplifiers, and Operational Amplifiers.

Design and to develop the Analog CMOS Circuits for different Analog operations.

Understand the concepts of Sample and Hold circuits and Open-Loop Comparators.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the knowledge of MOS devices and modeling.
CO2	Use different styles of CMOS Circuit modelling to synthesize analog ICs.
CO3	Apply appropriate biasing techniques to improve performance of analog circuits.
CO4	Design and Develop Analog Integrated Circuits using MOS Transistor.
CO5	Design and Develop CMOS Op Amps.
CO6	Assess the performance of sample and hold circuits and comparators in analog ICs suitable for societal use.

Course Content(Syllabus)

UNIT I

PART A: Basic MOS Devices: The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, Latch up in CMOS Technology, Short Channel Effects in MOS Transistors.

PART B: CMOS Device Modelling: Weak Inversion in MOS Transistors Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Sub-threshold MOS Model.

UNIT II

PART A: Current Mirrors: Current Sinks and Sources, Simple Current Mirrors, Simple Current Mirror with Source Degeneration, Cascode Current Mirror and Wilson Current Mirror.

PART B: Biasing Techniques: CS Biasing, CG Biasing, Source Follower Biasing, Differential Pair Biasing.

UNIT III

PART A: Single Stage Amplifiers: Common Source Stage with resistive load, Source follower, Common Gate Stage, Cascode Stage.

PART B: CMOS Operational Amplifiers: Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

UNIT IV

PART A: Sample and Hold Circuits:

Performance of Sample and Hold Circuits, MOS Sample and Hold Basics, Examples of CMOS S/H circuits, Bipolar and BICMOS Sample and Hold circuits.

PART B:Comparators:

Using an Opamp for a Comparator, Charge-Injection Errors, Latched Comparators, Examples of CMOS and BiCMOS Comparators.

TEXT BOOKS:

1. Design of Analog CMOS Integrated Circuits, Behzad Razavi, Tata McGraw Hill, 2nd Edition, 2008.

2.Analog Integrated Circuit Design- David A.Johns, Ken Martin, Wiley Student Edn, 2013.

REFERENCES:

1. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.

2.CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PS O2
CO1	3	-	-	-	2	-	-	2	-	-	-	-	3	-
CO2	-	-	2	-	3	-	3	-	-	-	-	3	-	3
CO3	3	3	-	-	-	-	-	-	-	-	2	-	2	-
CO4	-	-	3	3	-	-	-	-	3	-	-	-	-	-
CO5	-	2	-	-	3	-	-	-	-	2	-	-	-	-
CO6	3	2	-	-	-	3	-	-	-	-	-	3	-	-

IV Year - I Semester **L T P C**
3 0 0 0

MANDATORY COURSE
INDIAN CONSTITUTION

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	0	**External Marks:**	60

Prerequisites: Civics, Basics of Political Science.

Course Objectives:

- Understand the importance of constitution.
- Understand the structure of executive, legislature and judiciary.
- Understand philosophy of fundamental rights and duties.
- Understand the central and state relations, financial and administrative duties.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the meaning, history, features and characteristics of Indian Constitution.
CO2	Gain knowledge on fundamental rights duties and Principles and importance of State Policy.
CO3	Understand the powers of Union, the States and Indian President.
CO4	Know about amendments of the constitution and Emergency Provisions.
CO5	Understand the functioning of three wings of the government i.e., executive, legislative and judiciary.
CO6	Analyze the decentralization of power between central, state and local self-government.

Course Content(Syllabus)

UNIT I

Meaning of the constitution law and constitutionalism, Historical perspective of the constitution of India, Salient features and characteristics of the constitution of India.

UNIT II

Fundamental Rights under Indian constitution, scheme of the fundamental Rights, Scheme of the fundamental Right to Equality, Scheme of the fundamental Right to certain freedoms under Article 19 Scope of the right to life and personal Liberty under Article 21.

UNIT III

Federal structure and distribution of legislative and financial powers between the union and the states, Parliamentary form of government in India-the constitution powers and status of the President of India, Amendment of the constitutional powers and procedure, The historical perspectives of the constitutional amendments in India, Local self government-Constitutional Scheme in India.

UNIT IV

Emergency Provisions, National Emergency, President Rule, Financial Emergency
Statutory Institutions: Elections-Election Commission of India, National Human Rights Commission, National Commission for Women.

TEXT BOOKS:

1.The Constitution of India‖, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, —*Framing of Indian Constitution*‖, 1st Edition, 2015.

REFERENCES:

1.M. P. Jain, —*Indian Constitution Law*‖, 7th Edition., Lexis Nexis, 2014.
2.D.D. Basu, —*Introduction to the Constitution of India*‖, Lexis Nexis, 2015.
3. SubhashKashyap, Our Parliament, National Book Trust, New Delhi
4. Peu Ghosh, Indian Government &Politics, Prentice Hall of India, New Delhi
5. B.Z. Fadia&KuldeepFadia, Indian Government &Politics, Lexis Nexis, New Delhi

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PS O2
CO1	3	2	-	-	-	3-	-	-	-	-	-	-	-	-
CO2		3	2	-	-	-	-	2	-	-	-	-	-	-
CO3	3	-	2	-	-	-	3	-	3	-	-	2	-	-
CO4	-	-	3	-	-	-	-	2	-	-	-	2	-	-
CO5		2	-	3	-	-	-	-	-	-	-	-	-	-
CO6	3	2	-	-	-	-	-	-	-	-	-		-	-

IV Year - I Semester **L T P C**
0 0 2 1

Microwave Engineering and Optical Communication lab

Minimum 10 experiments should be conducted.
{ 6 experiments from part A and 4 experiments from part B}

Pre-Requisites: Analog Communication and Digital Communication.

Course Outcomes: The Students will be able to

- Verify characteristics of various microwave sources by conducting experiments with microwave bench setup.
- Analyze various parameters of Waveguide Components by conducting experiments with microwave bench setup.
- Estimate the power measurements of RF Components such as directional Couplers and circulators.
- Demonstrate characteristics of various optical sources by conducting experiments.
- Analyze the characteristics of optical fiber by conducting experiments and measuring various parameters.
- To demonstrate the Working of various Microwave Devices and components through microwave bench setup.

Part-A

Microwave Communications (Any Six Experiments)

1. Characteristics of the Reflex Klystron Tube

2. Characteristics of Gunn Diode

3. Determination of Voltage Standing Wave Ratio (**VSWR**)

4. Waveguide Parameters Measurement

5. Attenuation Measurement

6. Characteristics of Multihole Directional Coupler

7. Scattering Parameters of Circulator

8. Scattering Parameters of Magic Tee

Part-B

Optical Communications (Any Four Experiments)

1. V-I Characteristics of LED

2. Characteristics of Laser Diode

3. Measurement of Numerical Aperture of Optical fiber

4. Measurement of Losses in Analog Optical Link

5. Measurement of Data Rate Using Digital Optical Link

Equipment required for Laboratories:

1. Klystron Power Supply
2. Gunn Power Supply
3. VSWR Meter
4. Reflex klystron Tube
5. Gunn Diode
6. PIN diode
7. Waveguide Components
8. Microwave Bench setup with klystron Tube
9. Microwave Bench setup with Gunn diode
10. Optical Fibre Link Setup with LED
11. Optical Fibre Link Setup with LASER diode
12. CRO - 0 – 30 M Hz.

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AUTONOMOUS SYLLABUS

IV - II

IV Year - II Semester **L T P C**
3 0 0 3

PROFESSIONAL ELECTIVE-V
WIRELESS COMMUNICATIONS AND NETWORKS

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Antennas and Wave Propagation, Cellular Mobile communication, Analog Communication, Digital Communication.

Course Objectives:

- To understand the functions of wireless communication system and evolution of different wireless communication systems and standards.
- To be able to compare recent technologies used for wireless communication.
- To analyze and be able to explain the architecture, functioning, protocols, capabilities and applications of various wireless communication networks.
- To understand the concepts and be able to explain multiple access techniques for Wireless Communication.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the functioning of wireless communication system and evolution of different wireless communication systems and standards.
CO2	Compare different technologies used for wireless communication systems.
CO3	Explore the architecture, functioning, protocols, capabilities and application of various wireless communication networks.
CO4	Analyze various multiple access techniques for Wireless Communication.
CO5	Evaluate design challenges, constraints and security issues associated with wireless networks.
CO6	Acquire knowledge about various wireless data services and their performance.

Course Content(Syllabus)

UNIT I

PART A: Mobile Radio Propagation: Large-Scale Path Loss:
Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, Basic Propagation Mechanisms, **Reflection**: Reflection from Dielectrics, Brewster Angle, Reflection from prefect conductors, Ground Reflection (Two-Ray) Model, **Diffraction**: Fresnel Zone Geometry, Knife-edge Diffraction Model, Multiple knife-edge Diffraction, Scattering.
PART B: Outdoor Propagation Models- Longley-Ryce Model, Okumura Model, Hata Model, PCS Extension to Hata Model, **Indoor Propagation Models**- Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model.

UNIT II

PART A:Mobile Radio Propagation: Small –Scale Fading and Multipath
Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Impulse Response Model of a multipath channel, **Small-Scale Multipath Measurements**-Direct RF Pulse System, Spread Spectrum Sliding Correlator Channel Sounding, Frequency Domain Channels Sounding, **Parameters of Mobile Multipath Channels**-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time.
PART B:Types of Small- Scale Fading- Fading effects Due to Multipath Time Delay Spread, Flat fading and Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow

fading, **Statistical Models for multipath Fading Channels**-Clarke‟s model for flat fading, spectral shape due to Doppler spread in Clarke‟s model, Simulation of Clarke and Gans Fading Model, Level crossing and fading statistics, Two-ray Rayleigh Fading Model.

UNIT III

PART A: Equalization and Diversity-Introduction, Fundamentals of Equalization, Training a Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Non-linear Equalization-Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer.

PART B: Algorithms for adaptive equalization-Zero Forcing Algorithm, Least Mean Square Algorithm, Recursive least squares algorithm. **Diversity** -Derivation of selection Diversity improvement, Derivation of Maximal Ratio Combining improvement, **Practical Space Diversity Consideration**-Selection Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, Polarization Diversity, Frequency Diversity, Time Diversity, RAKE Receiver.

UNIT IV

PART A: Wireless Networking. Introduction to Wireless Networks. Differences Between Wireless and Fixed Telephone Networks. Development of Wireless Networks. Fixed Network Transmission Hierarchy. Traffic Routing in Wireless Networks.

PART B: Wireless Data Services: Common Channel Signaling (CCS). Integrated Services Digital Network (ISDN). Signaling System No. 7 (SS7). Network Service part (NSP) of SS7,The SS7 user parts, Signaling Traffic in SS7, SS7 services, Performance of SS7.

TEXT BOOKS:

1 Wireless Communications, Principles, Practice – Theodore, S. Rappaport, 2nd Ed., 2002, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
3. Mobile Cellular Communication – Gottapu Sasibhushana Rao, Pearson Education, 2012.

REFERENCES:

1. Principles of Wireless Networks – KavehPahLaven and P. Krishna Murthy, 2002, PE
2. Wireless Digital Communications – KamiloFeher, 1999, PHI.
3. Wireless Communication and Networking – William Stallings, 2003, PHI.
4. Wireless Communication – UpenDalal, Oxford Univ. Press.
5. Wireless Communications and Networking – Vijay K. Gary, Elsevier.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PSO2
CO1	3	3	-	2	-	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	3	-	3	-	-	3	-	-	-	2
CO3	3	3	-	-	-	-	-	3	-	-	-	-	3	-
CO4	-	-	3	-	3	-	-	-		-	-	2	-	-
CO5	3	2	2	-	3	-	-	-	-	-	-	-	-	3
CO6	-	2	-	-	-	2	-	-	-	-	2	-	-	-

IV Year - II Semester **L T P C**
3 0 0 3

PROFESSIONAL ELECTIVE-V
SOFT COMPUTING TECHNIQUES

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Electronic Devices and circuits, Linear IC Applications.

Course Objectives:

- To provide an introduction to the basic principles, techniques, and applications of soft computing.
- To understand the basic areas of Soft Computing including Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms.
- To provide the mathematical background for carrying out the optimization associated with neural network learning.
- To develop some familiarity with current research problems and research methods in Soft Computing by working on a research or design project.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand human intelligence and artificial intelligence.
CO2	Know how intelligent system works.
CO3	Apply basics of Fuzzy logic and neural networks.
CO4	Analyze the fuzzy sets, fuzzy logic and use of heuristics based on human experience.
CO5	Relate with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
CO6	Understand genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.

Course Content(Syllabus)

UNIT I

Part-A (Introduction to Soft Computing): What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing.

Part-B: various types of soft computing techniques, Fuzzy Computing, Neural Computing Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Classification, Probabilistic reasoning.

UNIT II

Part-A (Fundamentals of Artificial Neural Network):

What is Neural Network, Learning rules and various activation functions, Single layer Perceptrons , Back Propagation networks, Architecture of Back propagation(BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory.

Part-B: Introduction, Model of Artificial Neuron, Architectures, Learning Methods, Deep learning, Taxonomy of ANN Systems, Single- Layer ANN System, Supervised Learning Neural Networks, Perceptrons, Adaline, Mutilayer Perceptrons Applications of ANN in research.

UNIT III

Part-A (.Fuzzy Set Theory & Fuzzy Systems) :

Fuzzy set theory, Fuzzy set versus crisp set, Crisp relation & fuzzy relations, introduction & features of membership functions, Extension Principle, Fuzzy If-Then Rules, Sugeno Fuzzy Models, Fuzzification, Defuzzification, Applications.

Part-B: (Fuzzy Logic) : Fuzzy Sets – Properties – Membership Functions – Fuzzy Operations. Fuzzy Logic and Fuzzy Inference System

UNIT IV

Part-A(Genetic Algorithms and Hybrid Systems) :

Fundamentals of Genetic Algorithms, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling,

Part-B: Hybrid Systems: Integration of Neural Networks, Fuzzy Logic and Genetic Algorithms, Research orientation of soft computing techniques**.**

TEXT BOOKS:

1 J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004.

2. Simon O. Haykin "Artificial Neural Network", PHI, 2003

3. Elaine Rich, Kevin Knight, Artificial Intelligence TMH, 2009

REFERENCES:

1 Timothy J.Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill, 1997.

2. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.

3. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.

4. R.Eberhart, P.Simpson and R.Dobbins, "Computational Intelligence – PC Tools", AP Professional, Boston, 1996.

5. Dan W. Patterson, Introduction to AI and Expert System, PHI, 2009.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PS O2
CO1	3	-	2	-	3	-	-	-	-	-	-	2	-	-
CO2	-	3		2	-	-	-	2	-	-	-	-	-	3
CO3	2	3	-	3	-	3	-	-	-	-	-	-	-	-
CO4	2	-	3	3	-	-	-	-	2	-	2	-	-	2
CO5	2	3	-	-	-	-	-	2	-	-	-	-	3	-
CO6	-	3	2	-	-	-	-	-	-	3	-	-	-	-

IV Year – II Semester **L T P C**
3 0 0 3

PROFESSIONAL ELECTIVE-V
DIGITAL IC DESIGN

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Electronic Devices and circuits, Linear IC Applications.

Course Objectives:

- Understand the behavior of MOS Devices and Small-Signal & Large-Signal Modeling of MOS Transistor and Analog Sub-Circuits.
- Study CMOS Amplifiers like Differential Amplifiers, Cascade Amplifiers, Output Amplifiers, and Operational Amplifiers.
- Design and to develop the Analog CMOS Circuits for different Analog operations.
- Understand the concepts of Sample and Hold circuits and Open-Loop Comparators.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Understand the knowledge of MOS devices and modeling.
CO2	Use different styles of CMOS Circuit odeling to synthesize analog Ics.
CO3	Apply appropriate biasing techniques to improve performance of analog circuits.
CO4	Design and Develop Analog Integrated Circuits using MOS Transistor.
CO5	Design and Develop CMOS Op Amps.
CO6	Assess the performance of sample and hold circuits and comparators in analog Ics suitable for societal use.

Course Content(Syllabus)

UNIT I

PART A: Basic MOS Devices: The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, Latch up in CMOS Technology, Short Channel Effects in MOS Transistors.

PART B: CMOS Device Modelling: Weak Inversion in MOS Transistors Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Sub-threshold MOS Model.

UNIT II

PART A: Current Mirrors: Current Sinks and Sources, Simple Current Mirrors, Simple Current Mirror with Source Degeneration, Cascode Current Mirror and Wilson Current Mirror.

PART B: Biasing Techniques: CS Biasing, CG Biasing, Source Follower Biasing, Differential Pair Biasing.

UNIT III

PART A: Single Stage Amplifiers: Common Source Stage with resistive load, Source follower, Common Gate Stage, Cascode Stage.

PART B: CMOS Operational Amplifiers: Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

UNIT IV

PART A: Sample and Hold Circuits:

Performance of Sample and Hold Circuits, MOS Sample and Hold Basics, Examples of CMOS S/H circuits, Bipolar and BICMOS Sample and Hold circuits.

PART B: Comparators:

Using an Opamp for a Comparator, Charge-Injection Errors, Latched Comparators, Examples of CMOS and BiCMOS Comparators.

TEXT BOOKS:

1. Design of Analog CMOS Integrated Circuits, Behzad Razavi, Tata McGraw Hill, 2nd Edition, 2008.

2.Analog Integrated Circuit Design- David A.Johns, Ken Martin, Wiley Student Edn, 2013.

REFERENCES:

1. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R. G. Meyer, Wiley India, Fifth Edition, 2010.

2.CMOS Analog Circuit Design – Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PS O2
CO1	3	3	-	-	2	-	-	-	-	-	2	-	-	2
CO2	3	3	-	-		-	-	-	-	-	-	3	3	-
CO3	3	3	-	-	-	-	2	-	-	3	-	-	-	-
CO4	-	-	3	3	3	-	-	-	2	-	-	-	3	-
CO5	3	2	-	-	3	-	-	-	-	-	-	-	3	-
CO6	3	2	-	-	-	3	-	3	-	-	-	3	-	-

IV Year – II Semester **L T P C**
3 0 0 3

PROFESSIONAL ELECTIVE-VI
COMPUTER NETWORKS

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Basic concepts of networks, Analog Communication, Digital Communication.

Course Objectives:

- Understand the layered communication architectures (OSI and TCP/IP).
- Understand various network topologies required for communications.
- Demonstrate the Functions of various protocols of Data link layer and understand the basics of error detection including parity, checksums, and CRC.
- Demonstrate Functioning of various Routing protocols.
- Analyze the Functions of various Transport layer protocols.
- Understand the significance of application layer protocols.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Acquire knowledge about different network models like OSI and TCP/IP and various network topologies like WAN, LAN and MAN.
CO2	Distinguish different modes of wired transmission media such as copper wire, twisted pair wire, OFC and wireless transmission media.
CO3	Analyze various error detection techniques and functions of various protocols of Data link layer.
CO4	Analyze MAC layer protocols and LAN technologies.
CO5	Design different routing protocols and acquire knowledge on significance of various Flow control and Congestion control Mechanisms.
CO6	Acquire Knowledge on functioning of various Application layer Protocols.

Course Content(Syllabus)

UNIT I

PART A: Introduction: Network Topologies WAN, LAN, MAN. Reference models- The OSI Reference Model- the TCP/IP Reference Model - A Comparison of the OSI and TCP/IP Reference Models.

PART B: Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols

UNIT II

PART A: The Data Link Layer - Services Provided to the Network Layer – Framing – Error Control – Flow Control, Error Detection and Correction, Sliding Window Protocols-A One Bit Sliding Window Protocol-A Protocol Using Go-Back-N- A Protocol Using Selective Repeat.

PART B: The Medium Access Control Sublayer -The Channel Allocation Problem-Static Channel Allocation-Assumptions for Dynamic Channel Allocation, Multiple Access Protocols-Aloha-Carrier Sense Multiple Multiple Access Protocols- Collision-Free Protocols-Limited Contention Protocols-Wireless LAN Protocols.

UNIT III

PART A: The Network Layer - Design Issues – Store and Forward Packet Switching-Services Provided to the Transport layer- Implementation of Connectionless Service-Implementation of Connection Oriented Service- Comparison of Virtual Circuit and Datagram Networks

PART B: Routing Algorithms-The Optimality principle-Shortest path Algorithm, Congestion Control Algorithms-Approaches to Congestion Control-Traffic Aware Routing-Admission Control-Traffic Throttling-Load Shedding.

UNIT IV

PART A: Transport Layer: Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and De-multiplexing.

PART B: Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N(GBN), Selective Repeat(SR),**Connection Oriented Transport:** TCP - The TCP Connection, TCP Segment Structure. **Application Layer:** The DNS, Electronic Mail , FTP Commands and Replies

TEXT BOOKS:

1.Computer Networks, Tanenbaum and David J Wetherall, 5th Edition, Pearson Edu, 2010

2.Computer Networks: A Top Down Approach, Behrouz A. Forouzan, Firouz Mosharraf, McGraw Hill Education

REFERENCES:

1.Larry L. Peterson and Bruce S. Davie, "Computer Networks - A Systems Approach" (5th ed), Morgan Kaufmann/ Elsevier, 2011

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PSO2
CO1	3	2	-	2	-	-	-	-	-	-	-	3	3	-
CO2	2	-	2	-	1	-	-	-	3	-	-	-	-	-
CO3	3	2	-	2	-	3	-	-	-	-	-	-	-	2
CO4	2	-	1	-	-	-	-	2	-	-	2	-	3	-
CO5	-	2	2	-	2	-	2	-	-	-	-	-	-	-
CO6	3	-	2	-	2	-	-	-	-	2	-	2	-	2

IV Year - II Semester **L T P C**
3 0 0 3

PROFESSIONAL ELECTIVE-VI
INTERNET OF THINGS AND APPLICATIONS

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Embedded Systems, Microcontrollers, Operating Systems.

Course Objectives:

- To Understand Smart Objects and IoT architecture.
- To introduce the concept of M2M (machine to machine) with necessary protocols.
- To acquaint with the various security concepts in IoT architecture.
- To build simple IOT system using Arduino and Raspberry PI platform.
- To understand data analytics and cloud in the context of IOT.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Summarize on the term 'internet of things' in different contexts and to analyze various protocols for IoT.
CO2	Comprehend and analyze Software defined networks.
CO3	Explore IT Access Technologies and security for IEEE 802.15.4, 802.15.4g, 802.15.4e, 802.11ah and Lora WAN.
CO4	Explore and learn about Internet of Things with the help of preparing projects designed using Arduino and Raspberry Pi.
CO5	Apply data analytics and use cloud offerings related to design and develop a solution for a given application using APIs and test for errors in the application.
CO6	Implement real field problem by gained knowledge of Industrial applications with IoT capability.

Course Content(Syllabus)

UNIT I

PART A: INTRODUCTION TO INTERNET OF THINGS:

Definition and characteristics of IOT, Evolution of IOT, Logical view of IOT ecosystem, Functional blocks of IOT: Sensors, Actuators, Smart Objects and connecting smart objects, Physical design of IOT-IOT Protocols, IOT Communication models, Calm and Ambient Technologies.

PART B:FUNDAMENTALS OF IOT:

The Internet of Things: An overview, The Flavor of the IOT, Design principles for connected devices, IOT Architectures, OneM2M, IOT World Forum (IoTWF) and alternative IOT Models.

UNIT II

PART A: IOT and M2M:

Software defined networks, Network Function Virtualization, Difference between SDN and NFV for IOT, Basics of IOT system management with NETCONF, YANG-NETCONF, YANG, and NETOPEER.

PART B: IOT PRINCIPLES & IOT COMMUNNICATION ARCHITECTURE:

IOT nodes, IOT Edges, 6 LOWPAN, Optimizing IP for IOT: IP, TCP, The IP Protocol suite (TCP/IP), UDP, IP Address, Static IP Address Assignment, Dynamic IP Address Assignment, IPV4 & IPV6.

UNIT III

PART A: IOT PROTOCOLS:

IT Access Technologies: Physical and MAC Layer, Topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 802.11ah and Lora WAN.

PART B: IOT PHYSICAL DEVICES & END POINTS:

Embedded Computing basics, Microcontrollers, System-On-Chip, IOT system building blocks, Arduino, Raspberry PI – Installation, Interfaces (Serial, SPI, I2C).

UNIT IV

PART A: IOT PHYSICAL SERVERS AND CLOUD OFFERINGS:

Introduction to Cloud Storage models and Communication API Servers- Web Server for IOT , Cloud for IOT, Getting started with an API, Mashing up API, Scraping, Legalities, Writing a New API, Application Layer Protocols: MQTT, COAP, Extensible Messaging and presence protocol (xmpp).

PART B: INTRODUCTION TO INDUSTRY 4.0 AND II0T:

Defining Industry 4.0, Characteristics of Industry 4.0, and Benefits to Business, Industry 4.0 Design Principles, Building blocks of Industry 4.0, Industry 4.0 Reference Architecture, and Smart Factories. Concept of 5G Technology: A New Step to IOT Platform. Case study/ Industrial Application.

TEXT BOOKS:

1 Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012.

2. Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.

3.The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012.

4. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.

5. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

6. Industry 4.0; The Industrial Internet of Things, Alasdair Gilchrist.

REFERENCES:

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan.

2. Internet of Things Architecture Final Architectural Reference Model for the IoT v3.0, http://www.iot-a.eu/public.

3. From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier.

4. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PSO2
CO1	3	-	-	-	2	3	-	-	3	-	2	2	3	-
CO2	-	2	-	3	-	-	-	-	2	-	-	-	-	3
CO3	-	3	2	-	-	1	-	2	-	3	3	2	2	-
CO4	3	-	-	3	-	-	-	-	3	-	-	3	-	-
CO5	-	2	-	-	-	-	-	-	2	-	2	-	-	3
CO6	-	-	2	-	2	-	2	-	-	2	-	2	-	-

IV Year - II Semester **L T P C**
3 0 0 3

PROFESSIONAL ELECTIVE-VI
ARTIFICIAL INTELLIGENCE

Lecture – Tutorial:	3-0 Hours	**Internal Marks:**	40
Credits:	3	**External Marks:**	60

Prerequisites: Data Structures, Algorithms and Probability

Course Objectives:

- To learn the difference between optimal reasoning vs human like reasoning.
- To understand the notions of state space representation, exhaustive search, heuristic search alongwith the time and space complexities.
- To learn different knowledge representation techniques
- To understand the applications of AI: namely Game Playing, Theorem Proving, Expert Systems,Machine Learning and Natural Language Processing

Course Outcomes:

Upon successful completion of the course, the student will be able to:

CO1	Formulate an efficient problem space for a problem expressed in English.
CO2	Identify a search algorithm for a problem and characterize its time and spacecomplexities.
CO3	Acquire skills for representing knowledge using the appropriate technique.
CO4	Apply AI techniques to solve problems of Game Playing, Expert Systems, Machine Learning and Natural Language Processing.
CO5	Apply the knowledge to develop the solutions for real life problems.
CO6	Develop new algorithms to contribute to the research arena.

Course Content(Syllabus)

UNIT I

PART A: Introduction: History, Intelligent Systems, Foundations of AI, Sub areas of AI, Applications.

PART B: Problem Solving: State-Space Search and Control Strategies: Introduction, General Problem Solving, Characteristics of Problem, Exhaustive Searches, Heuristic Search Techniques, Iterative-Deepening A*, Constraint Satisfaction.

UNIT II

PART A: Logic Concepts and Logic Programming: Introduction, Propositional Calculus, Propositional Logic, Natural Deduction System, Resolution Refutation in Propositional Logic, Predicate Logic, Logic Programming.

PART B: Representing Knowledge Using Rules: Logic programming, Procedural Vs Declarative knowledge, Forward Vs Backward Reasoning, Matching, Control Knowledge.

UNIT III

PART A: Knowledge Representation: Introduction, Approaches to Knowledge Representation, KnowledgeRepresentation using Semantic Network, Extended Semantic Networks for KR.

PART B: Knowledge Representation using Frames: Conceptual dependencies, Scripts.

UNIT IV

PART A: Natural Language Processing: Steps in The Natural Language Processing, Syntactic Processing and Augmented Transition Nets, Semantic Analysis, NLP Understanding Systems.

PART B: Fuzzy Logic: Crisp Sets, Fuzzy Sets, Fuzzy Logic Control, Fuzzy Inferences & Fuzzy Systems Planning with state-space search – partial-order planning – planning graphs – planning and acting in the real world.
AI Programming languages: Overview of LISP and PROLOG, Production System in Prolog.

TEXT BOOKS:

1. Artificial Intelligence, Elaine Rich and Kevin Knight, Tata Mc graw-Hill Publications.

2. Introduction To Artificial Intelligence & Expert Systems, Patterson, PHI publications.

REFERENCES:

1. Artificial Intelligence, George F Luger, Pearson Education Publications
2.Artificial Intelligence : A modern Approach, Russell and Norvig, Printice Hall
3.Artificial Intelligence, Robert Schalkoff, Mcgraw-Hill Publications
4.Artificial Intelligence and Machine Learning, Vinod Chandra S.S., Anand Hareendran S.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)

	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	PSO2
CO1	3	2	2	-	-	-	-	3	-	-	-	-	-	-
CO2	-	2	2	1	-	3	-	-	-	-	-	-	3	-
CO3	3	-		-	1	-	3	-	-	3	-	-	-	-
CO4	-	2	3	-	-	-	-	-	-	-	-	-	3	2
CO5	3	-	2	-	2	-	-	-	-	3	2	-	-	-
CO6	-	2	3	1	-	-	-	-	1	-	-	-	3	1