Sri

SAI RAM INSTITUTE OF TECHNOLOGY

An Autonomous Institution

West Tambaram, Chennai - 44

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Approved by AICTE, New Delhi
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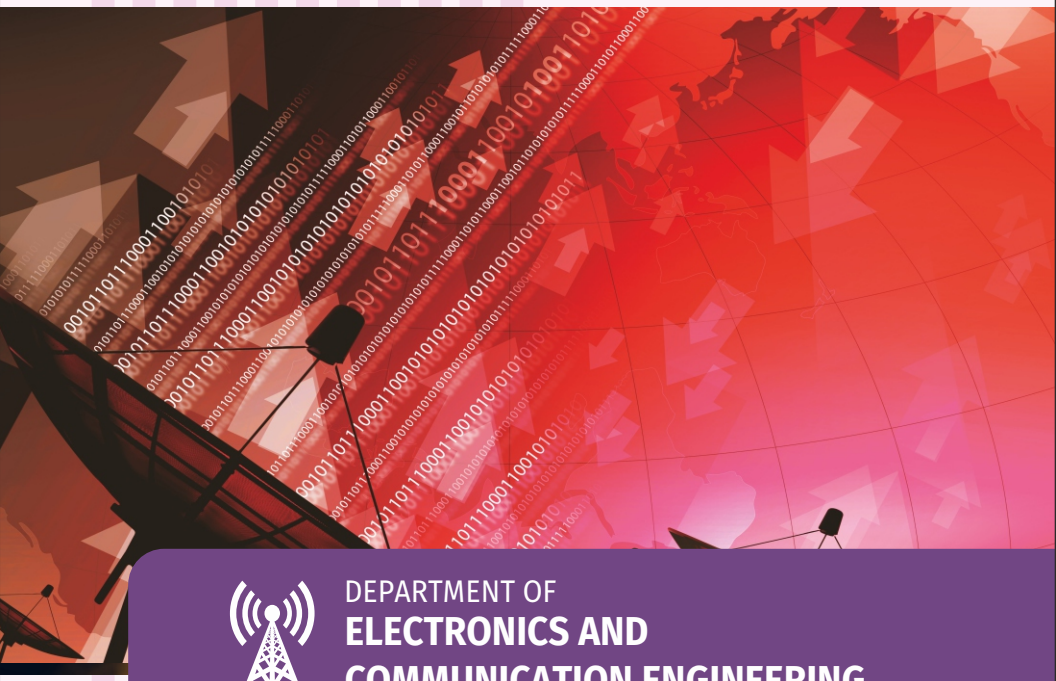

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

REGULATIONS 2020

Academic Year 2020-21 onwards

AUTONOMOUS

CURRICULUM AND

SYLLABUS I - VIII

SEMESTERS

SRI SAIRAM INSTITUTE OF TECHNOLOGY

VISION

To be identified as a "Centre of Excellence" with high standards of Knowledge Dissemination and Research opportunities and to transform the students to imbibe qualities of technical expertise of international standards and high levels of ethical values, who in turn shall contribute to the advancement of society and human kind.

MISSION

We shall dedicate and commit ourselves to attain and maintain excellence in Technical Education through commitment and continuous improvement of infrastructure and equipment and provide an inspiring environment for Learning, Research and Innovation for our students to transform them into complete human beings with ethical and social values.

QUALITY POLICY

We at Sri Sai Ram Institute of Technology are committed to build a better nation through Quality Education with team spirit. Our students are enabled to excel in all values of Life and become Good Citizens. We continually improve the System, Infrastructure and Services to satisfy the Students, Parents, Industry and Society.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG.

VISION

To become a leading department of excellence in academic and research imparting high quality technical education in Electronics and Communication Engineering through international standards and making our students technologically superior and ethically strong to serve the society and mankind.

MISSION

To create an inspiring environment that shall enhance the growth of innovative research professional excellences who can contribute to the society and mankind, ethical and societal values through life-long learning.

Sri SAI RAM INSTITUTE OF TECHNOLOGY

An Autonomous Institution

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B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

I - VIII SEMESTER
AUTONOMOUS CURRICULA AND SYLLABI
Regulations 2020

SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA101	Engineering Mathematics-I	3	1	0	4	4
2	20HSEN101	Technical English-I	3	0	0	3	3
3	20BSPH101	Engineering Physics	3	0	0	3	3
4	20BSCY101	Engineering Chemistry	3	0	0	3	3
5	20ESCS101	Problem solving and Programming in C	3	0	0	3	3
6	20ESGE101	Engineering Graphics	1	2	0	3	3
PRACTICAL							
7	20BSPL101	Physics and Chemistry Laboratory	0	0	3	3	1.5
8	20ESPL101	Programming in C Laboratory	0	0	3	3	1.5
VALUE ADDITIONS - I							
9	20TPHS101	Skill Enhancement	0	0	2	2	1
10	20HSMG101	Personal Values	2	0	0	2	0
TOTAL						**29**	**23**

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20BSMA201	Engineering Mathematics -II	3	1	0	4	4
2	20HSEN201	Technical English - II	3	0	0	3	3
3	20ESIT201	Python Programming with lab	3	0	2	5	4
4	20BSPH201	Physics of Electronic Devices	3	0	0	3	3
5	20ECPC201	Circuit Analysis	3	0	0	3	3
PRACTICAL							
6	20ESGE201	Engineering Practices Laboratory	0	0	3	3	1.5
7	20ECPL201	Circuits and Devices Laboratory	0	0	3	3	1.5
8	20ECTE201	PCB Design	0	0	2	2	1
VALUE ADDITIONS - II							
9	20TPHS201	Skill Enhancement	0	0	2	2	1
10	20HSMG201	Interpersonal Values	2	0	0	2	0
TOTAL						**30**	**22**

SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20ECPC301	Digital Electronics	3	0	0	3	3
2	20ECPC302	Electromagnetic Fields & Waveguides	3	1	0	4	4
3	20ECPC303	Signals and Systems	3	1	0	4	4
4	20ECPW301	R Programming with Laboratory	3	0	2	5	4
5	20BSMA301	Linear Algebra, Partial Differential Equations and Transforms	3	1	0	4	4
PRACTICAL							
6	20ECPL301	Digital Circuits Laboratory	0	0	3	3	1.5
7	20ECTE301	Live-in-Lab - I	0	0	2	2	1
VALUE ADDITIONS - III							
8	20ECTP301	Skill Enhancement	0	0	2	2	1
9	20MGMC301	Constitution of India	2	0	0	2	0
TOTAL						**28**	**22.5**

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20ECPC401	Communication Theory	3	0	0	3	3
2	20ECPW401	Electronic Circuits with Laboratory	3	0	2	5	4
3	20ECPW402	Linear integrated Circuits with Laboratory	3	0	2	5	4
4	20ECPC402	Microcontrollers & Embedded Systems	3	0	0	3	3
5	20BSMA401	Probability theory and Stochastic processes	3	1	0	4	4
6	20BSCY201	Environmental Science and Engineering	3	0	0	3	3
PRACTICAL							
7	20ECPL401	Microcontrollers & Embedded Systems Laboratory	0	0	3	3	1.5
VALUE ADDITIONS - IV							
8	20ECTE401	Live-in-Lab -II	0	0	2	2	1
9	20ECTP401	Skill Enhancement	0	0	2	2	1
TOTAL						**30**	**24.5**

SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20ECPC501	Digital Communication	3	0	0	3	3
2	20ECPW501	Discrete Time Signal Processing with Laboratory	3	0	2	5	4
3	20ECPC502	VLSI Design	3	0	0	3	3
4	20ECELXXX	Professional Elective-I	3	0	0	3	3
5	20XXOEXXX	Open Elective-I	3	0	0	3	3
PRACTICAL							
6	20ECPL501	Communication Systems Laboratory	0	0	3	3	1.5
7	20ECPL502	VLSI Laboratory	0	0	3	3	1.5
8	20ECTE501	Live-in-Lab III	0	0	4	4	2
VALUE ADDITIONS - V							
9	20ECTP501	Skill Enhancement	0	0	2	2	1
TOTAL						**29**	**22**

SEMESTER VI

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20ECPC601	Transmission Lines & Antennas	3	0	0	3	3
2	20ECPC602	Communication Networks	3	0	0	3	3
3	20ECPC603	Wireless Communication	3	0	0	3	3
4	20ECELXXX	Professional Elective-II	3	0	0	3	3
5	20XXOEXXX	Open Elective - II	3	0	0	3	3
PRACTICAL							
6	20HSPL501	Communication and Soft Skills Laboratory	0	0	2	2	1
7	20ECPL601	Antennas Laboratory	0	0	3	3	1.5
8	20ECPL602	Networks Laboratory	0	0	3	3	1.5
9	20ECPJ601	Innovative Design Project	0	0	2	2	1
VALUE ADDITIONS - VI							
10	20ECTP601	Skill Enhancement	0	0	2	2	1
		TOTAL				**27**	**21**

SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20ECPC701	RF and Microwave Engineering	3	0	0	3	3
2	20ECPC702	Optical Communication	3	0	0	3	3
3	20CSPC601	Artificial Intelligence	3	0	0	3	3
4	20ECELXXX	Professional Elective-III	3	0	0	3	3
5	20HSMG601	Principles of Engineering Management	3	0	0	3	3
PRACTICAL							
6	20ECPL701	Advanced Communication Laboratory	0	0	3	3	1.5
7	20CSPL601	Artificial Intelligence Laboratory	0	0	3	3	1.5
8	20ECPJ701	Project Phase - I	0	0	4	4	2
VALUE ADDITIONS - VII							
9	20ECTP701	Skill Enhancement	0	0	2	2	1
		TOTAL				**27**	**21**

SEMESTER VIII

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDITS
			L	T	P		
THEORY							
1	20ECELXXX	Professional Elective - IV	3	0	0	3	3
PRACTICAL							
2	20ECPJ801	Project Phase - II	0	0	8	8	4
TOTAL						11	7

PROFESSIONAL ELECTIVES - I

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20ECEL501	Soft Computing	3	0	0	3	3	Signal Processing
2	20ECEL502	Television and Broadcasting Services	3	0	0	3	3	Wireless
3	20ECEL503	Medical Electronics	3	0	0	3	3	Signal Processing
4	20ECEL504	Nano Technology and Applications	3	0	0	3	3	VLSI
5	20ECEL505	Digital Image Processing	3	0	0	3	3	Signal Processing
6	20ECEL506	Control Systems Engineering	3	0	0	3	3	RF
7	20ECEL507	Industrial IOT	3	0	0	3	3	Wireless

PROFESSIONAL ELECTIVES - II

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20ECEL601	Wireless Networks	3	0	0	3	3	Wireless
2	20ECEL602	DSP Processor Architecture and Programming	3	0	0	3	3	Signal Processing
3	20ECEL603	Electro Magnetic Interference and Compatibility	3	0	0	3	3	RF& Green
4	20ECEL604	FPGA and ASIC Design	3	0	0	3	3	VLSI
5	20ECEL605	Electronics Packaging and Testing	3	0	0	3	3	VLSI
6	20ECEL606	MEMS and NEMS	3	0	0	3	3	VLSI
7.	20MGEL601	Total Quality Management	3	0	0	3	3	Management

PROFESSIONAL ELECTIVES - III

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20ECEL701	Cognitive Radio	3	0	0	3	3	Wireless
2	20ECEL702	Wireless Sensor Networks	3	0	0	3	3	Wireless
3	20ECEL703	Mixed Signal IC Design	3	0	0	3	3	VLSI
4	20ECEL704	Pattern Recognition	3	0	0	3	3	Signal Processing
5	20ECEL705	Radar and Navigational Aids		3	0	0	3 3	RF & Green
6	20MGEL701	Foundation Skills in Integrated Product Development	3	0	0	3	3	Management
7.	20MGEL707	Intellectual Property Rights	3	0	0	3	3	Management

PROFESSIONAL ELECTIVES - IV

S. NO	COURSE CODE	COURSE TITLE	WEEK HOURS			TOTAL CONTACT HOURS	CREDIT	STREAM
			L	T	P			
1	20ECEL801	Underwater Wireless Communication Systems	3	0	0	3	3	Wireless
2	20ECEL802	Mobile Ad Hoc Networks	3	0	0	3	3	Wireless
3	20ECEL803	Satellite Communication	3	0	0	3	3	RF & Green
4	20ECEL804	CMOS Analog IC Design	3	0	0	3	3	VLSI
5	20ECEL805	Photonic Networks	3	0	0	3	3	RF & Green
6	20CSEL802	Deep Learning Principles & Practices	3	0	0	3	3	Signal Processing
7	20HSMG301	Professional Ethics and Values	3	0	0	3	3	Management

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Graduates are prepared to analyze and solve Engineering problem with strong background in Scientific, Mathematical and Engineering fundamentals to develop solutions in various research areas of Electronics and Communication Engineering.

PEO2 Graduates are trained with good scientific and engineering breadth to design and create novel products and solutions for real world problems.

PEO3 Graduates are equipped with the qualities of Professional leadership for improving the technical and career growth in multidisciplinary domain that leads to societal benefits.

PEO4 Graduates are involved in Professional activities and industry oriented training programme which enhances their employability with good communication skills.

PEO5 Graduates are motivated to develop Professional Excellency which inculcates ethical and moral behavior through life-long learning.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1 An ability to recognize, adapt and to apply the knowledge of Electronics and Communication to optimize communication systems and to develop techno-economical real world applications.

PSO2 An ability to design and conduct the experiments, analyze and interpret the data using modern software tools with proper understanding of basic concepts of Electronics and Communication Engineering.

PROGRAMME OUTCOMES(POs)

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

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

PO3. Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs

with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.

Po4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Po5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

Po6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

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

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

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

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

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

SEMESTER - I

20BSMA101 SDG NO. 4 & 9	ENGINEERING MATHEMATICS-I	L	T	P	C
		3	1	0	4

OBJECTIVES:

The intent of this course is

- To understand and gain knowledge in the concepts of matrix algebra
- To introduce the notion of limits, continuity, differentiation and maxima and minima of functions
- To acquaint the concept of definite and improper integrals and their applications
- To provide an understanding of double and triple integrals
- To acquire knowledge in representing elementary and periodic functions as an infinite series

UNIT I MATRICES 12

Symmetric, skew symmetric and orthogonal matrices; Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem(excluding proof) – Reduction of a Quadratic form to Canonical form using Orthogonal Transformation - Nature of Quadratic forms.

UNIT II DIFFERENTIAL CALCULUS 12

Limit, continuity, Differentiation rules - Maxima and Minima of functions of one variable, partial derivatives, Taylor's series for functions of two variables, Jacobian, Maxima & Minima of functions of several variables, saddle points, Method of Lagrange multipliers.

UNIT III INTEGRAL CALCULUS 12

Evaluation of definite and improper integral - Techniques of Integration- Substitution rule - Integration by parts, Integration of rational functions by partial fraction, Integration of irrational functions - Applications of definite integrals to evaluate surface areas and volumes of revolution.

UNIT IV MULTIPLE INTEGRALS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

UNIT V SEQUENCES AND SERIES **12**

Introduction to sequences and series – power series – Taylor's series – series for exponential, trigonometric, logarithmic, hyperbolic functions – Fourier series – Half range Sine and Cosine series – Parseval's theorem.

TOTAL: 60 PERIODS

TEXTBOOKS:

1. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.
2. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.

REFERENCES:

1. G.B. Thomas and R.L. Finney, "Calculus and Analytic Geometry", 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, John Wiley & Sons, 2006.
3. T. Veerarajan, "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
4. N.P. Bali and Manish Goyal, "A text-book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.
5. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40th Edition, 2014.

WEB REFERENCES:

1. https://math.mit.edu/~gs/linearalgebra/ila0601.pdf
2. http://ocw.mit.edu/ans7870/18/18.013a/textbook/HTML/chapter30/
3. https://ocw.mit.edu/courses/mathematics/18-02sc-multivariable-calculus-fall-2010/2.-partial-derivatives/
4. http://ocw.mit.edu/ans7870/18/18.013a/textbook/HTML/chapter31/

ONLINE RESOURCES:

1. https://www.khanacademy.org/math/linear-algebra/alternate-bases/eigen-everything/v/linear-algebra-introduction-to-eigenvalues-and-eigenvectors
2. https://www.khanacademy.org/math/differential-calculus

OUTCOMES:

Upon completion of the course, the student should be able to

1. Find the eigen values, eigen vectors of a matrix, diagonalize the given matrix and apply matrix algebra to model various engineering problems.
2. Use differentiation techniques to optimize problems that arises in engineering.
3. Evaluate integrals and apply it in calculating surface areas and volumes of revolution.
4. Compute multiple integrals using change of variables technique and apply it in finding area and volume of solids.
5. Describe elementary and periodic functions as a series representation.

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	-	-	-	-	-	1	1
CO2	3	3	2	1	1	-	-	-	-	-	1	1
CO3	3	3	2	1	1	-	-	-	-	-	1	1
CO4	3	3	2	1	1	-	-	-	-	-	1	1
CO5	3	3	2	1	1	-	-	-	-	-	1	1

SEMESTER - I

20HSEN101 SDG NO. 4	TECHNICAL ENGLISH - I	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To develop the basic LSRW skills of the students
- To encourage the learners to adapt to listening techniques
- To help learners develop their communication skills and converse fluently in real contexts
- To help learners develop general and technical vocabulary through reading and writing tasks
- To improve the language proficiency for better understanding of core subjects

UNIT I INTRODUCTION 9

Listening – short texts – formal and informal conversations - **Speaking** – basics in speaking – speaking on given topics & situations – recording speeches and strategies to improve - **Reading** – critical reading – finding key information in a given text – shifting facts from opinions - **Writing** – free writing on any given topic – autobiographical writing - **Language Development** – tenses – voices- word formation: prefixes and suffixes – parts of speech – developing hints

UNIT II READING AND LANGUAGE DEVELOPMENT 9

Listening - long texts - TED talks - extensive speech on current affairs and discussions - **Speaking** – describing a simple process – asking and answering questions - **Reading** comprehension – skimming / scanning / predicting & analytical reading – question & answers – objective and descriptive answers –identifying synonyms and antonyms - process description - **Writing** instructions – **Language Development** – writing definitions – compound words - articles – prepositions.

UNIT III SPEAKING AND INTERPRETATION SKILLS 9

Listening - dialogues & conversations - **Speaking** – role plays – asking about routine actions and expressing opinions - **Reading** longer texts & making a critical analysis of the given text - **Writing** – types of paragraph and writing essays – rearrangement of jumbled sentences - writing recommendations - **Language Development** – use of sequence words - cause & effect expressions - sentences expressing purpose - picture based and newspaper based activities – single word substitutes.

UNIT IV VOCABULARY BUILDING AND WRITING SKILLS 9

Listening - debates and discussions – practicing multiple tasks – self introduction – **Speaking** about friends/places/hobbies - **Reading** -Making inference from the reading passage – Predicting the content of the reading passage - **Writing** – informal letters/e-mails - **Language Development** - synonyms & antonyms - conditionals – if, unless, in case, when and others – framing questions.

UNIT V LANGUAGE DEVELOPMENT AND TECHNICAL WRITING 9

Listening - popular speeches and presentations - **Speaking** - impromptu speeches & debates - **Reading** - articles – magazines/newspapers **Writing** – essay writing on technical topics - channel conversion – bar diagram/ graph – picture interpretation - process description - **Language Development** – modal verbs - fixed / semi-fixed expressions – collocations.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Board of Editors. Using English: A Coursebook for Undergraduate Engineers and Technologists. Orient Blackswan Limited, Hyderabad: 2015.
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai, 2011.

REFERENCES:

1. Anderson, Paul V. Technical Communication: A Reader – Centered Approach. Cengage, New Delhi, 2008.
2. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason, USA, 2007.
3. Grussendorf, Marion, English for Presentations, Oxford University Press, Oxford, 2007.
4. Chauhan, Gajendra Singh and et.al.Technical Communication (Latest Revised Edition). Cengage Learning India Pvt. Limited, 2018.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_hs31/preview
2. http://engineeringvideolectures.com/course/696

ONLINE RESOURCES:

1. https://www.pearson.com/english/catalogue/business-english/technical-english.html
2. https://www.cambridgeenglish.org/learning-english/free-resources/

OUTCOMES:

Upon completion of the course, the student should be able to

1. Comprehend conversations and talks presented in English.
2. Speak fluently in informal and formal contexts.
3. Read articles of any kind and be able to comprehend.
4. Prepare informal letters and e-mails efficiently.
5. Write technical concepts and summaries in correct grammar and vocabulary.

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	2	3	-	1
CO2	-	-	-	-	-	-	-	-	2	3	-	1
CO3	-	-	-	-	-	1	1	-	2	3	-	1
CO4	-	-	-	-	-	-	-	-	2	3	-	1
CO5	-	-	-	-	-	1	-	-	2	3	-	1

SEMESTER - I

20BSPH101 SDG NO. 4	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To educate and enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology

UNIT I CRYSTAL PHYSICS 9

Single crystalline, Polycrystalline and Amorphous materials - single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal - Miller indices - Interplanar distance - Powder diffraction method - Debye Scherer formula - Calculation of number of atoms per unit cell - Atomic radius - Coordination number - packing factor for SC, BCC, FCC and HCP structures - Polymorphism and allotropy - Diamond and Graphite structure (qualitative) - Growth of single crystals: Solution and Melt growth Techniques.

UNIT II PROPERTIES OF MATTER 9

Elasticity - Stress - strain diagram and its uses - Poisson's ratio - Relationship between three moduli of elasticity (qualitative) - Factors affecting elastic modulus and tensile strength - Twisting couple - shaft - Torsion pendulum: theory and experiment - bending of beams - bending moment - cantilever: theory and experiment - uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT III QUANTUM PHYSICS 9

Black body radiation - Planck's theory (derivation) - Compton effect: theory -

wave particle duality - electron diffraction - progressive waves - wave equation - concept of wave function and its physical significance - Schrödinger's wave equation - Time independent and Time dependent equations - particle in a box (one dimensional motion) - Tunneling (qualitative) - scanning tunneling microscope.

UNIT IV LASERS AND FIBER OPTICS 9

Lasers: population of energy levels, Einstein's A and B coefficients derivation - pumping methods - resonant cavity, optical amplification (qualitative) - three level and four level laser - CO_2 laser - Semiconductor lasers: Homojunction and Heterojunction.

Fiber optics: Principle, Numerical aperture and Acceptance angle - Types of optical fibers (material, refractive index, mode) - Losses associated with optical fibers - Fiber Optical Communication system (Block diagram) - Fiber optic sensors: pressure and displacement.

UNIT V THERMAL PHYSICS 9

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

TOTAL : 45 PERIODS

TEXT BOOKS:

1. D.K. Bhattachary & T.Poonam, "Engineering Physics". Oxford University Press, 2015.
2. R.K. Gaur& S.L. Gupta, "Engineering Physics". Dhanpat Rai Publishers, 2012.
3. B.K. Pandey & S.Chaturvedi, "Engineering Physics", Cengage Learning India, 2017.
4. V. Rajendran, "Engineering Physics", Mc Graw Hill Publications Ltd. New Delhi, 2014.
5. M.N. Avadhanulu& P.G. Kshirshagar, "A textbook of Engineering Physics", S. Chand & Co Ltd. 2016.

REFERENCES:

1. D. Halliday, . Resnick & J. Walker, "Principles of Physics", Wiley, 2015.
2. R.A. Serway, & J.W. Jewett, "Physics for Scientists and Engineers", Cengage Learning, 2010.
3. N.K. Verma," Physics for Engineers", PHI Learning Private Limited, 2014.

4. P.A. Tipler & G. Mosca "Physics for Scientists and Engineers", W.H.Freeman, 2020.
5. Brijlal and Subramanyam, "Properties of Matter", S. Chand Publishing, 2018.
6. Shatendra Sharma & Jyotsna Sharma, "Engineering Physics", Pearson, 2018.

OUTCOMES :

Upon completion of the course, the student should be able to

1. Understand the basics of crystals, their structures and different crystal growth techniques.
2. Understand the basics of properties of matter and its potential applications.
3. Get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscope.
4. Acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics.
5. Evaluate the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers.

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-		1	-	-	-	-	1
CO2	3	3	3	3	-	3	2	-	-	-	-	1
CO3	3	3	3	3	-	1	1	-	-	-	-	2
CO4	3	3	3	3	-	3	3	-	-	-	-	3
CO5	3	3	3	3	-	3	2	-	-	-	-	1

SEMESTER - I

20BSCY101 SDG NO. 4,6&7	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To make the students conversant with boiler feed water requirements, related problems and water treatment techniques
- To illustrate the principles of electrochemical reactions, redox reactions in corrosion of materials and methods for corrosion prevention and protection of materials
- To categorize types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels
- To demonstrate the principles and generation of energy in batteries, nuclear reactors, solar cells, windmills and fuel cells
- To recognize the applications of polymers, composites and nano-materials in various fields

UNIT I WATER TECHNOLOGY AND SURFACE CHEMISTRY 9

Water Technology : Introduction – Hard water and Soft water. Hardness of water – types – expression of hardness (numerical problems). Boiler troubles – scale and sludge, priming and foaming, caustic embrittlement and boiler corrosion. Treatment of boiler feed water – Internal treatment (carbonate, phosphate, calgon, colloidal and sodium aluminate conditioning). External treatment – Ion exchange process, Zeolite process –Domestic water treatment (break point chlorination) –Desalination of brackish water – Reverse Osmosis.

Surface Chemistry: Adsorption – types – adsorption of gases on solids – adsorption of solutes from solution – applications of adsorption –role of adsorbents in catalysis and pollution abatement.

UNIT II ELECTROCHEMISTRY AND CORROSION 9

Electrochemistry: Cells – types (electrochemical and electrolytic cell) Redox reaction – single electrode potential (oxidation potential and reduction potential) – measurement and applications –Nernst equation (derivation and problems) – electrochemical series and its significance.

Corrosion: Causes, factors and types – chemical and electrochemical corrosion (galvanic, differential aeration). Corrosion control – material selection and design aspects, cathodic protection methods (sacrificial anodic and impressed current cathodic method) and corrosion inhibitors. Paints: Constituents and its functions. Electroplating of Copper and electroless plating of Nickel.

UNIT III FUELS AND COMBUSTION 9

Fuels: Introduction – classification of fuels – Coal – analysis of coal (proximate and ultimate). Carbonization – manufacture of metallurgical coke (Otto Hoffmann method) – Petroleum – manufacture of synthetic petrol (Bergius process). Knocking – octane number and cetane number – Gaseous fuels – Compressed natural gas (CNG), Liquefied petroleum gases (LPG). Biofuels – Gobar gas and Biodiesel.

Combustion of Fuels: Introduction – calorific value – higher and lower calorific values- theoretical calculation of calorific value – flue gas analysis (ORSAT Method).

UNIT IV ENERGY SOURCES AND STORAGE DEVICES 9

Energy sources: Nuclear fission – nuclear fusion – differences between nuclear fission and fusion – nuclear chain reactions – nuclear energy – light water nuclear power plant – breeder reactor – solar energy conversion – solar cells – wind energy.

Storage devices: Batteries – types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium–ion–battery), fuel cells – H_2 -O_2 fuel cell and super capacitors.

UNIT V POLYMERS AND NANOMATERIALS 9

Polymers: Classification – types of polymerization – mechanism (Free radical polymerization) –Engineering polymers: Nylon–6, Nylon–6,6, Teflon, Kevlar and PEEK – preparation, properties and uses – Plastic and its types – Conducting polymers – types and applications. Composites – definition, types, polymer matrix composites – FRP.

Nanomaterials: Introduction – Nanoparticles, Nanoclusters, Nanorods, Nanotubes (CNT: SWNT and MWNT) and Nanowires – Properties (surface to volume ratio, melting point, optical and electrical), Synthesis (precipitation, thermolysis, hydrothermal, electrodeposition, chemical vapour deposition, laser ablation, sol-gel process) and Applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand & Company LTD, New Delhi, 2015.
2. P. C. Jain and Monika Jain, "Engineering Chemistry" DhanpatRai Publishing Company (P) LTD, New Delhi, 2015.
3. S. Vairam, P. Kalyani and Suba Ramesh, "Engineering Chemistry", Wiley India PVT, LTD, New Delhi, 2013.

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
2. Prasanta Rath, "Engineering Chemistry", Cengage Learning India PVT, LTD, Delhi, 2015.
3. Shikha Agarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, 2015.

OUTCOMES

Upon completion of the course, the student should be able to

1. Identify the origin of water resources and develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.
2. Apply the principles of electrochemistry, corrosion and the applications of protective coatings to overcome the corrosion.
3. Illustrate the chemistry of fuels and combustion and its application in various levels.
4. Acquire the basics of non-conventional sources of energy and understand the principles and the reaction mechanism of batteries and fuel cells.
5. Build knowledge about the polymers, composites and nano-materials and their applications as engineering materials.

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	-	1	2	-	-	-	-	2
CO2	3	2	3	2	2	1	2	-	-	-	-	3
CO3	3	2	2	2	-	1	2	1	-	-	-	1
CO4	3	2	3	2	-	1	2	1	-	-	1	1
CO5	3	2	3	1	2	1	1	-	-	-	1	3

SEMESTER - I

20ESCS101 SDG NO. 4&9	PROBLEM SOLVING AND PROGRAMMING IN C	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand about the programming language
- To develop C Programs using basic Programming Constructs, Loops Arrays and Strings
- To develop applications in C using Functions , Pointers and Structures
- To perform I/O operations and File Handling in C

UNIT I INTRODUCTION TO PROGRAMMING AND ALGORITHMS FOR PROBLEM SOLVING 10

The Basic Model of Computation, Programming Paradigms- Program Development Life Cycle - Algorithm –Pseudo Code – Flow Chart - Programming Languages - Compilation - Linking and Loading - Testing and Debugging - Documentation - Control Structures – Algorithmic Problem Solving- Problems Based on Sequential, Decision Making - Branching and Iteration.

UNIT II BASICS OF C PROGRAMMING 8

Structure of C program - C programming: Data Types – Storage Classes - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions – Input / Output Statements - Assignment Statements – Decision making Statements - Switch Statement - Looping Statements – Pre-Processor Directives - Compilation Process

UNIT III ARRAYS AND STRINGS 9

Introduction to Arrays: Declaration, Initialization – One Dimensional Array – Example Program: Computing Mean, Median and Mode - Two Dimensional Arrays – Example Program: Matrix Operations (Addition, Scaling, Determinant and Transpose) - String Operations: Length, Compare, Concatenate - Copy – Selection Sort - Linear and Binary Search.

UNIT IV FUNCTIONS AND POINTERS 9

Introduction to Functions: Function Prototype, Function Definition, Function Call, Built-in Functions (String Functions, Math Functions) – Recursion – Example Program: Computation of Sine Series - Scientific Calculator using Built-in Functions - Binary Search using Recursive Functions – Pointers – Pointer Operators – Pointer Arithmetic – Arrays and Pointers –

Array of Pointers – Example Program: Sorting of Names – Parameter Passing: Pass by Value - Pass by Reference – Example Program: Swapping of Two Numbers using Pass by Reference.

UNIT V STRUCTURES and FILE PROCESSING 9

Structure - Nested Structures – Pointer and Structures – Array of Structures – Example Program using Structures and Pointers – Self Referential Structures – Dynamic Memory Allocation - Singly Linked List – Typedef.

Files – Types of File Processing: Sequential Access, Random Access – Sequential Access File - Example Program: Finding Average of Numbers stored in Sequential Access File - Random Access File - Example Program: Transaction Processing Using Random Access Files – Command Line Arguments.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2012.

REFERENCES:

1. Paul Deitel and Harvey Deitel, "C How to Program", Seventh edition, Pearson Publication.
2. Jeri R. Hanly & Elliot B. Koffman, "Problem Solving and Program Design in C", Pearson Education, 2013.
3. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009.
4. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.
6. Kanetkar Y, "Let us C", BPB Publications, 2007.
7. Hanly J R & Koffman E.B, "Problem Solving and Programme design in C", Pearson Education, 2009.

WEB REFERENCES:

1. https://www.learn-c.org/
2. https://codeforwin.org/
3. https://www.cprogramming.com/

ONLINE RESOURCES:

1. https://www.linuxtopia.org/online_books/programming_books/gnu_c_programming_tutorial
2. https://nptel.ac.in/courses/106105171
3. https://swayam.gov.in/nd1_noc19_cs42/preview

OUTCOMES:

Upon completion of the course the student should be able to

1. Develop efficient algorithms for solving a problem.
2. Use the various constructs in C to develop simple applications.
3. Design and Implement applications using Array & Strings.
4. Develop applications using Functions and Pointers.
5. Design and Develop applications using Structures and Files.

CO- PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	1	1	1	2	2	3	3
CO2	3	3	3	3	2	1	1	1	2	2	3	3
CO3	3	3	3	3	2	1	1	1	2	2	3	3
CO4	3	3	3	3	2	1	1	1	2	2	3	3
CO5	3	3	3	3	2	1	1	1	2	2	3	3

SEMESTER - I

20ESGE101 SDG NO. 4,6,7, 9, 12,14 &15	ENGINEERING GRAPHICS	L	T	P	C
		1	2	0	3

OBJECTIVES:

- To develop in students, graphic skills for communication of concepts, ideas and design of engineering products
- To visualize the job in three dimensions
- To have a clear conception and appreciation of the shape, size, proportion and design
- To expose the student community to existing national standards related to technical drawings

CONCEPTS AND CONVENTIONS (Not for Examination) 3

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

UNIT I PLANE CURVES AND FREEHAND SKETCHING 6+9

Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid on Horizontal Surfaces – construction of involutes of circle for one complete revolution – Drawing of tangents and normal to the above curves.

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

UNIT II PROJECTION OF LINES AND PLANE SURFACE 6+9

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

UNIT III PROJECTION OF SOLIDS 6+9

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+9

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

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+9

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinder, cone- Perspective projection of simple solids-Prisms, pyramids and cylinder by visual ray method.

TOTAL: 78 PERIODS

TEXT BOOKS:

1. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.
2. T. Jeyapoovan, "Engineering Graphics using AUTOCAD", Vikas Publishing House Pvt Ltd, 7th Edition.

REFERENCES:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
3. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
4. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Stores, Bangalore, 2007.
5. Luzzader, Warren.J. and Duff,John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
6. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.
7. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson, 2nd Edition, 2009.

WEB REFERENCES:

1. https://nptel.ac.in/courses/112/103/112103019/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/105/104/105104148/

PUBLICATION OF BUREAU OF INDIAN STANDARDS:

1. IS10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods

OUTCOMES:

Upon completion of the course, the student should be able to

1. Familiarize with the fundamentals and standards of Engineering graphics and Perform freehand sketching of basic geometrical constructions and multiple views of objects.
2. Acquire knowledge in the Angle of Projection, projection of Points, Lines and Plane Surfaces.
3. Understand different Positions of Solids.
4. Able to visualize the Sectioned area of Solids and develop its Lateral Surfaces.
5. Generate and Interpret Orthographic, Pictorial and perspective views.

CO - PO MAPPING:

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

SEMESTER - I

20BSPL101 SDG NO. 4	PHYSICS AND CHEMISTRY LABORATORY	L	T	P	C
		0	0	3	1.5

PHYSICS LABORATORY

OBJECTIVES:

- To acquaint the students with practical knowledge of physics principles in various fields such as optics, thermal physics and properties of matter for developing basic experimental skills
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis

LIST OF EXPERIMENTS (Any 5 Experiments)

1. Determination of Young's modulus by non-uniform bending method.
2. Determination of rigidity modulus –Torsion pendulum.

3. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
4. (a) Determination of wavelength and particle size using Laser.
   (b) Determination of acceptance angle in an optical fiber.
5. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
6. Determination of specific resistance of a given coil of wire – Carey Foster's bridge.
7. Determination of wavelength of mercury spectrum – spectrometer grating.
8. Determination of band gap of a semiconductor.
9. Determination of Hall coefficient by Hall Effect experiment.
10. Determination of solar cell characteristics.

LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS / 6 (max.) STUDENTS PER EXPERIMENT

1. Young's modulus by non-uniform bending method-experimental set-up – 12 sets
2. Rigidity modulus - Torsion pendulum experimental set-up – 12 sets
3. Ultrasonic Interferometer to determine velocity of sound and compressibility of liquid – 6 sets
4. (a) Experimental set-up to find the wavelength of light, and to find particle size using Laser – 6 sets
   (b) Experimental set-up to find acceptance angle in an optical fiber – 6 sets
5. Lee's disc method- experimental set up to find thermal conductivity of a bad conductor – 6 sets
6. Experimental set-up to find specific resistance of a coil of wire-Carey Foster's Bridge – 6 sets
7. Experimental set-up to find the wavelength of mercury spectrum-spectrometer grating – 6 sets
8. Experimental set-up to find the band gap of a semiconductor – 12 sets
9. Experimental set-up to find the Hall coefficient by Hall Effect Experiment – 6 sets
10. Experimental set-up to study characteristics of solar cells – 6 sets

TEXTBOOKS:

1. J.D. Wilson& C.A. Hernandez Hall "Physics Laboratory Experiments" Houghton Mifflin Company, New York, 2010.

2. M.N. Srinivasan, S. Balasubramanian &R. Ranganathan, "Practical Physics", S. Chand & Sons educational publications, New Delhi, 2011.
3. R. Sasikumar, "Practical Physics", PHI Learning Pvt. Ltd., New Delhi, 2011.

CHEMISTRY LABORATORY

(Any five experiments to be conducted)

OBJECTIVES:

- To acquaint the students with practical knowledge of the basic concepts of chemistry, the student faces during the course of their study in the industry and engineering field
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis
- To understand and develop experimental skills for building technical competence

LIST OF EXPERIMENTS (Any five experiments to be conducted)

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water samples.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Determination of strength of given hydrochloric acid using pH meter.
6. Conductometric titration of strong acid vs strong base.
7. Estimation of iron content of the given solution using potentiometer.
8. Estimation of iron content of the water sample using spectrophotometer (1, 10- Phenanthroline / thiocyanate method).
9. Estimation of sodium and potassium present in water using flame photometers.
10. Determination of molecular weights of polymers using Ostwald's Viscometer.

LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS / 6 (MAX.) STUDENTS PER EXPERIMENT.

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample - 6 sets

2. Determination of total, temporary & permanent hardness of water by EDTA method - 6 sets
3. Determination of DO content of water sample by Winkler's method - 6sets
4. Determination of chloride content of water sample by argentometric method – 6 sets
5. Determination of strength of given hydrochloric acid using pH meter - 6 sets
6. Conductometric titration of strong acid vs strong base - 6 sets
7. Estimation of iron content of the given solution using potentiometer - 6 sets
8. Estimation of iron content of the water sample using spectrophotometer (1,10- Phenanthroline / thiocyanate method) - 2 sets
9. Estimation of sodium and potassium present in water using flame photometer - 2 sets
10. Determination of molecular weights of polymer using Ostwald's Viscometer. - 6 sets

TOTAL: 30 PERIODS

TEXTBOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis (8th edition, 2014).

OUTCOMES:

Upon completion of the course, the student should be able to

1. Apply the principles of thermal physics and properties of matter to evaluate the properties of materials and to determine the physical properties of liquid using ultrasonic interferometer.
2. Understand measurement technique and usage of new instruments in optics for real time application in engineering.
3. Apply the knowledge of semiconductor materials to evaluate the band gap and Hall coefficient of materials and to study the characteristics of solar cell for Engineering solutions.
4. Apply basic techniques used in chemistry laboratories for water analyses/purification and estimates the ions/metal ions present in domestic/industry wastewater.
5. Utilize the fundamental laboratory techniques for analyses such as volumetric titrations, conductometric, potentiometric and spectroscopy.

CO- PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1	3	3	2	2	1	1	3
CO2	3	3	3	3	3	3	3	2	2	2	2	3
CO3	3	3	3	3	3	3	3	2	1	1	2	3
CO4	3	2	3	3	1	1	2	2	2	2	3	2
CO5	3	2	3	3	1	1	2	2	2	2	3	2

SEMESTER - I

20ESPL101 SDG NO. 4&9	PROGRAMMING IN C LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To develop programs in C using basic Programming Constructs
- To develop applications in C using Arrays and Strings
- To design and implement applications in C using Functions, Structures
- To develop applications in C using Files

LIST OF EXPERIMENTS

1. Write a program using I/O statements and expressions.
2. Write programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Write a program to perform the Calculator operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Write a program to check whether a given number is Armstrong number or not?
6. Write a program tocheck whether a given number is odd or even?
7. Write a program to find the factorial of a given number.
8. Write a program to find out the average of 4 integers.
9. Write a program to display array elements using two dimensional arrays.
10. Write a program to perform swapping using function.
11. Write a program to display all prime numbers between two intervals using functions.
12. Write a program to reverse a sentence using recursion.

13. Write a program to get the largest element of an array using the function.
14. Write a program to concatenate two string.
15. Write a program to find the length of String.
16. Write a program to find the frequency of a character in a string.
17. Write a program to store Student Information in Structure and Display it.
18. The annual examination is conducted for 10 students for five subjects. Write a program to read the data and determine the following:
    (a) Total marks obtained by each student.
    (b) The highest marks in each subject and the marks of the student who secured it.
    (c) The student who obtained the highest total marks.
19. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
20. Count the number of account holders whose balance is less than the minimum balance using sequential access file.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Standalone desktops with C compiler 30 Nos.

(or)

Server with C compiler supporting 30 terminals or more.

OUTCOMES:

Upon completion of the course, the student should be able to

1. Solve some simple problems leading to specific applications.
2. Demonstrate C programming development environment, compiling, debugging, linking and executing a program.
3. Develop C programs for simple applications making use of basic constructs, arrays and strings.
4. Develop C programs involving functions, recursion, pointers, and structures.
5. Design applications using sequential and random access file.

CO- PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	1	1	1	2	2	3	3
CO2	3	3	3	3	2	1	1	1	2	2	3	3
CO3	3	3	3	3	2	1	1	1	2	2	3	3
CO4	3	3	3	3	2	1	1	1	2	2	3	3
CO5	3	3	3	3	2	1	1	1	2	2	3	3

SEMESTER - I

20TPHS101 SDG NO. 4&5	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To enrich social network ethics
- To develop and enhance browsing culture
- To understand the concepts of networking
- To promote self professionalism
- To acquire knowledge about various digital identification procedures

UNIT I SOCIAL NETWORK ETIQUETTES **6**

Introduction to social network – Social Networking Etiquettes - Pros and Cons - Usage of Facebook, Instagram, WhatsApp , Telegram, Youtube, Evolution of Android and IOS, Introduction to Linkedin & Benefits. (Practicals – Official Mail id- Linkedin Id Creation, Linkedin Profile Bulilding , Facebook Id and Creation and Modifying the existing FB ID)

UNIT II BROWSING CULTURE **6**

Introduction to browsing – Search Engines-Google - Bing -Yahoo!-AOL -MSN –DuckDuckGo ,browsers, phishing – Cookies - URL – https:// extensions , browsing history, Incognito mode- VPN – Pros and Cons – Book mark.

UNIT III NETWORKING **6**

Basics of networking - LAN, MAN, WAN, Introduction to network topologies, Protocols , IP Commands (Command line prompt), Define online complier and

editor (Practicals – Find Your System IP,Ping Command, Firewall Fortinet, Basic DOS Commands)

UNIT IV PROFESSIONALISM **6**

Dress Code, Body Language, Appropriate Attire ,Communication Skills, Interview preparation – Introducing yourself - How to greet Superiors, Importance of Eye Contact During conversation.

UNIT V DIGITAL IDENTIFICATION **6**

Introduction to NAD - Importance of Aadhar, PAN Card, Passport, Bank Account, Bar Code, QR scan, Payment Gateway (Gpay, Phone Pe, UPI, BHIM, Paytm), Mobile Banking (Practicals - NAD registration Step by Step, Linking bank account with netbanking , Register for payment gateway).

TOTAL : 30 PERIODS

WEB REFERENCES :

Unit I: Social Network Etiquettes:

1. https://sproutsocial.com/glossary/social-media-etiquette/
2. https://www.shrm.org/resourcesandtools/tools-and-samples/hr-qa/pages/socialnetworkingsitespolicy.aspx
3. https://www.frontiersin.org/articles/10.3389/fpsyg.2019.02711/full
4. https://medium.com/@sirajea/11-reasons-why-you-should-use-telegram-instead-of-whatsapp-ab0f80fbfa79
5. https://buffer.com/library/how-to-use-instagram/
6. https://www.webwise.ie/parents/what-is-youtube/
7. https://www.androidauthority.com/history-android-os-name-789433/
8. https://www.mindtools.com/pages/article/linkedin.htm

Unit II: Browsing Culture:

1. https://sites.google.com/site/bethanycollegeofteacheredn/unit--ict-connecting-with-world/national-policy-on-information-and-communication-technology-ict/accessing-the-web-introduction-to-the-browser-browsing-web
2. https://www.wordstream.com/articles/internet-search-engines-history
3. https://www.malwarebytes.com/phishing/
4. https://www.adpushup.com/blog/types-of-cookies/
5. https://www.eff.org/https-everywhere
6. https://www.sciencedirect.com/topics/computer-science/browsing-history\

7. https://www.vpnmentor.com/blog/pros-cons-vpn/
8. https://www.tech-wonders.com/2016/10/use-hush-private-bookmarking-extension-chrome.html

Unit III:Networking

1. https://www.guru99.com/types-of-computer-network.html
2. https://www.studytonight.com/computer-networks/network-topology-types
3. https://www.cloudflare.com/learning/network-layer/what-is-a-protocol/
4. https://www.howtogeek.com/168896/10-useful-windows-commands-you-should-know/
5. https://paiza.io/en

Unit IV : Professionalism

1. https://career.vt.edu/develop/professionalism.html
2. https://englishlabs.in/importance-dress-code/
3. https://www.proschoolonline.com/blog/importance-of-body-language-in-day-to-day-life
4. https://www.thespruce.com/etiquette-of-proper-attire-1216800
5. https://shirleytaylor.com/why-are-communication-skills-important/
6. https://www.triad-eng.com/interview-tips-for-engineers/
7. https://www.indeed.co.in/career-advice/interviewing/interview-question-tell-me-about-yourself
8. https://toggl.com/track/business-etiquette-rules/

Unit V: Digital Identification

1. https://nad.ndml.in/nad-presentation.html
2. https://www.turtlemint.com/aadhaar-card-benefits/
3. https://www.bankbazaar.com/pan-card/uses-of-pan-card.html
4. https://www.passportindex.org/passport.php
5. https://consumer.westchestergov.com/financial-education/money-management/benefits-of-a-bank-account
6. https://en.wikipedia.org/wiki/QR_code
7. https://www.investopedia.com/terms/p/payment-gateway.asp
8. https://www.paisabazaar.com/banking/mobile-banking/

OUTCOMES:

Upon completion of the course, the student should be able to

1. Learn and apply social network ethics.
2. Understand the browsing culture.
3. Analyze the networking concepts .
4. Develop self professionalism.
5. Gain hands-on experience in various digital identification procedures.

CO- PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	3	2	-	3	2	3	-	2
CO2	-	-	-	-	3	2	-	3	2	3	-	2
CO3	-	-	-	-	3	2	-	-	1	3	-	2
CO4	-	-	-	-	3	2	-	3	3	3	-	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2

SEMESTER - I

20HSMG101 SDG NO. 4&5	PERSONAL VALUES	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Values through Practical activities

UNIT I SELF CONCEPT **6**

Understanding self Concept – Identify Yourself – Who am I – an individual, engineer, citizen – Attitude – Measuring Behaviour – Change of Behaviour – Personality – Characteristics in personal, professional life.

UNIT II INDIVIDUAL VALUES **6**

Personal Values – Attributes –Courage – Creativity, Honesty, Perfection, Simplicity, Responsibility – Measuring personal values

UNIT III MORAL VALUES **6**

Moral – Understanding right and wrong – Positive thoughts – Respect to others – Doing good to society.

UNIT IV PHYSICAL AND MENTAL WELL-BEING **6**

Health – Physical fitness –Mental vigour – Diet management – Yoga – Meditation – Peaceful life – Happiness in life

UNIT V DECISION MAKING **6**

Goal Setting – Decision making skill – Overcome of Barriers – Success – Mental strength and weakness

TOTAL: 30 PERIODS

Note:

Each topic in all the above units will be supplemented by practice exercises and classroom activities and projects.

REFERENCE BOOKS:

1. Barun K. Mitra, "Personality Development and Soft Skills", Oxford University Press, 2016.
2. B.N.Ghosh, "Managing Soft Skills for Personality Development" McGraw Hill India, 2012.

OUTCOMES:

Upon completion of the course, the student should be able to

1. Become an individual in knowing the self.
2. Acquire and express Personal Values, Spiritual values and fitness.
3. Practice simple physical exercise and breathing techniques.
4. Practice Yoga asana which will enhance the quality of life.
5. Practice Meditation and get benefitted.

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	2	3	3	1	1	1
CO2	-	-	-	-	-	2	2	3	3	1	1	1
CO3	-	-	-	-	-	2	2	3	3	1	1	1
CO4	-	-	-	-	-	2	2	3	3	1	1	1
CO5	-	-	-	-	-	2	2	3	3	1	1	1

SEMESTER - II

20BSMA201 SDG NO. 4	ENGINEERING MATHEMATICS - II	L	T	P	C
		3	1	0	4

OBJECTIVES:

- The objective of this course is to familiarize the prospective engineers with techniques in Vector Calculus, Ordinary differential equations, Complex variables and Laplace transforms. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

UNIT I VECTOR CALCULUS 12

Gradient and Directional derivatives - Divergence and Curl- Vector identities - Irrotational and Solenoidal vector fields - Line integral over a plane curve - Surface integral - Volume integral – Gauss divergence, Green's and Stoke's theorems - Verification and application in evaluating line, Surface and volume integrals.

UNIT II ORDINARY DIFFERENTIAL EQUATIONS 12

Second and higher order linear differential equations with constant coefficients - Method of variation of parameters - Homogeneous equation of Euler's and Legendre's types - System of simultaneous linear differential equations with constant coefficients.

UNIT III COMPLEX DIFFERENTIATION 12

Analytic functions- Necessary and sufficient conditions for analyticity in cartesian and polar coordinates (without proof) - Properties - Harmonic conjugate - construction of analytic functions- Conformal mapping - Mapping by functions $w = z+a, w=az, w=1/z, w=z^2$ - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Contour integrals, Cauchy- Goursat theorem (without proof) - Cauchy Integral formula (without proof) - Taylor's series - Zeroes of Analytic functions - Singularities - Laurent's Series - Residues – Cauchy Residue theorem (without proof) – Application of Residue theorem for evaluation of real integrals – use of circular contour and semicircular contour(without poles on real axis).

UNIT V LAPLACE TRANSFORM 12

Existence conditions – Transforms of elementary functions – Transform of Unit step function and Unit impulse function – Basic properties – Shifting

theorems – Transforms of derivatives and integrals – Initial and Final value theorems – Convolution theorem – Transform of Periodic functions – Application of solution of linear second order ordinary differential equations with constant coefficients.

TEXT BOOKS:

1. Ramana.B.V., "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2008.
2. Erwin Kresizg, "Advance Engineering Mathematics", 9th Edition, John Wiley &Sons, 2006.

REFERENCES:

1. Dass, H.K., and Er. Rajnish Verma, "Higher Engineering Mathematics", S.Chand Private Ltd., 2011.
2. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2010.
3. Peter V.O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning, 2012.
4. E.A.Coddinton, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.
5. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 40th Edition, 2014.
6. N.P.Bali and Manish Goyal, "A text Book of Engineering Mathematics", Laxmi Publications, Reprint 2008.

WEB COURSES:

1. https://nptel.ac.in/courses/122107036/
2. https://nptel.ac.in/courses/111105134/
3. https://ocw.mit.edu/courses/mathematics/18-04-complex-variables-with-applications-spring-2018/
4. https://ocw.mit.edu/courses/mathematics/18-02-multivariable-calculus-fall-2007/
5. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/

ONLINE RESOURCES:

1. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/lecture-1-introduction/
2. http://www.nptelvideos.com/course.php?id=90

COURSE OUTCOMES:

Upon completion of the course, the student should be able to

1. Apply the concepts of vector differentiation and integration in various engineering problems.
2. Use Differential equations in solving physical problems.
3. Construct analytic functions and discuss various transformations.
4. Identify the nature of singularities, evaluate residues and contour integrals.
5. Use Laplace transform techniques in solving differential equation that occurs in various engineering problems.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	-	-	-	-	-	1	1
CO2	3	3	2	1	1	-	-	-	-	-	1	1
CO3	3	3	2	1	1	-	-	-	-	-	1	1
CO4	3	3	2	1	1	-	-	-	-	-	1	1
CO5	3	3	2	1	1	-	-	-	-	-	1	1

SEMESTER - II

20HSEN201 SDG NO. 4	TECHNICAL ENGLISH - II	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To strengthen the listening skills for comprehending and critically analyzing passages
- To enhance students' ability with multiple strategies and skills for making technical presentations
- To participate in group discussions for developing group attitude
- To develop skills for preparing effective job application
- To write effective technical reports

UNIT I LANGUAGE DEVELOPMENT 9

Listening – conversations involving two participants – multiple participants – **Speaking** – conversation methods in real life occurrences using expressions of different emotions and imperative usages – **Reading** passages and short stories - **Writing** – preparation of checklist – extended definition – **Language Development** – tenses - subject - verb agreement

UNIT II VOCABULARY BUILDING 9

Listening – listening formal and informal conversation and participative exercises – **Speaking** - creating greetings/wishes/excuses and thanks – **Reading** – articles/novels - **Writing** summary of articles and concise writing identifying new words – homonyms, homophones, homographs – one-word substitutions – easily confused words - creating SMS and using emoticons - sharing information in social media. **Language Development** - reported speeches – regular and irregular verbs - idioms & phrases

UNIT III WRITING TECHNICAL REPORTS 9

Listening – listening conversation – effective use of words and their sound aspects, stress, intonation & pronunciation – **Speaking** - practicing telephonic conversations – observing and responding. **Reading** – regular columns of newspapers/magazines - **Writing** – reports – feasibility, accident, survey and progress - preparation of agenda and minutes – **Language Development** - using connectives – discourse markers.

UNIT IV TECHNICAL WRITING 9

Listening – Model debates & documentaries - **Speaking** – expressing agreement/disagreement, assertiveness in expressing opinions – **Reading** biographies/autobiographies – **Writing** – note-making – formal letters – inviting guests – acceptance/declining letters - **Language Development** – degrees of comparison - numerical adjectives – embedded sentences.

UNIT V GROUP DISCUSSION AND JOB APPLICATION 9

Listening - classroom lectures – recommending suggestions & solutions – **Speaking** – participating in group discussion – learning GD strategies – Reading – journal articles - **Writing** – Job application – cover letter - résumé preparation – **Language Development** – purpose statement – editing – verbal analogies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Board of editors. "Fluency in English: A Course book for Engineering and Technology". Orient Blackswan, Hyderabad 2016.
2. Ashraf Rizvi. M, "Effective Technical Communication", 2nd ed. McGraw Hill, New Delhi, 2018.

REFERENCES:

1. Bailey, Stephen. "Academic Writing: A Practical Guide for Students", Routledge, New York,2011.
2. Raman, Meenakshi and Sharma, Sangeetha, "Technical Communication Principles and Practice", Oxford University Press, New Delhi, 2014.

3. Muralikrishnan & Mishra Sunitha, "Communication skills for Engineers", 2nd ed. Pearson, Tamilnadu, India 2011. P. Kiranmai and Rajeevan, Geetha. Basic Communication Skills, Foundation Books, New Delhi, 2013.
4. Suresh Kumar, E., "Engineering English", Orient Blackswan, Hyderabad, 2015.
5. Richards, Jack C. "Interchange Students" Book – 2, Cambridge University Press, New Delhi, 2015.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_hs21/preview
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/109106122/lec1.pdf
3. https://freevideolectures.com/course/3250/introduction-to-film-studies/10

ONLINE RESOURCES:

1. https://www.ef.com/wwen/english-resources/
2. https://www.smilesforlearning.org/gclid=EAIaIQobChMI49DF9bnd6AIVSY6PCh1d_gV9EAAYASAAEgIBPvD_BwE

OUTCOMES:

Upon completion of the course, the student should be able to

1. Acquire the ability to speak effectively in real life situations.
2. Adapt group behaviour and execute the role as a contribution team member.
3. Improve active and passive vocabulary.
4. Share opinions and suggestions effectively in conversations, debates and discussions.
4. Frame winning job applications and write reports convincingly.

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	3	3	-	-
CO2	-	-	-	-	-	-	-	-	3	3	-	1
CO3	-	-	-	-	-	1	1	2	3	3	-	1
CO4	-	-	-	-	-	-	-	-	3	3	-	1
CO5	-	-	-	-	-	1	-	2	3	3	-	1

SEMESTER - II

20ESIT201 SDG NO. 4	PYTHON PROGRAMMING WITH LABORATORY	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To Develop Python Programs with Conditionals and Loops
- To Use Python Data Structures – Lists, Tuples, Dictionaries, Sets
- To Define Python Functions and Work with Modules and Packages
- To Work with Python Classes, Objects and Handling Exceptions

UNIT I BASICS OF PYTHON PROGRAMMING 9

Python Interpreter and Interactive Mode - Features – History of Python – Literals – Variables and Identifiers – Data Types – Input Operation – Comments – Reserved Words – Indentation – Operators and Expressions – Operator Precedence– Operations on Strings – Other Data types – Type Conversion - Illustrative Programs: Use of various Operators, Evaluation of expressions, String Operations.

UNIT II DECISION CONTROL STATEMENTS 9

Conditionals: Boolean Values and Operators, Conditional (if) - Alternative (if-else) - Chained Conditional (if-elif-else) - Iteration: state - while - for - break - continue - pass - Illustrative Programs: Exchange the Values of Two Variables - Circulate the values of N Variables - Distance Between Two Points - Square Root - GCD - Exponentiation - Sum and Array of Numbers.

UNIT III STRING, LISTS, TUPLES, DICTIONARIES, SETS 9

Strings: String Slices - Immutability - String functions and methods - String Module - Lists: List Operations - List Slices - List methods - List Loop - Mutability - Aliasing - Cloning lists - List Parameters - Tuples: Tuple Assignment - Tuple as return value - Dictionaries: Operations and Methods - Advanced List Processing - List Comprehension - Sets: Creating Sets – Operations and Methods – Set Comprehension - Illustrative programs: Linear Search - Binary Search - Selection Sort - Insertion Sort - Merge Sort - Histogram.

UNIT IV FUNCTIONS, MODULES AND PACKAGES 9

Functions - Function Definition and Use - Flow of Execution - Parameters and Arguments - Fruitful Functions: Return values - Parameters - Local and Global

Scope - Function Composition - Recursion - Modules – from-import Statement – Name of Module – Making your own modules - Packages - Standard Library Modules – globals(), locals() and reload() - Illustrative programs: Fibonacci Series using functions - Arithmetic Operations using Module - Area of different shapes using Packages.

UNIT V CLASSES, OBJECTS AND EXCEPTION HANDLING 9

Classes and Objects – Defining Classes – Creating Objects – Data Abstraction and Hiding through Classes - init() method – Class Variables and Object Variables – Introduction to Errors and Exception Handling – Handling Exceptions – Multiple Except Blocks – else Clause – Raising Exceptions – Built-in and User-defined Exceptions – Finally Block.

LIST OF EXPERIMENTS 15

1. Write a Python program to perform
   a. Linear Search
   b. Binary Search
2. Write a Python program to perform Selection Sort.
3. Write a Python program to sort the given numbers using Insertion Sort.
4. Write a Python program to do sorting using Merge sort.
5. Write a Python program to find first n prime numbers.
6. Write a Python program to Multiply two matrices.
7. Write a Python program to create Student class and instantiate its Object.
8. Write a Python License verification process using Exception handling.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. ReemaThareja. "Python Programming Using Problem Solving Approach", Oxford University Press 2018.
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, O'Reilly Publishers, 2016.

REFERENCES:

1. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python" Revised and updated for Python 3.2, Network Theory Ltd., 2011.
2. John V Guttag, "Introduction to Computation and Programming Using Python", Revised and expanded Edition, MIT Press , 2013.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-Disciplinary Approach", Pearson India

Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
6. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus", Wiley India Edition, 2013.
7. Paul Gries, Jennifer Campbell and Jason Montojo, "Practical Programming: An Introduction to Computer Science using Python 3", Second edition, Pragmatic Programmers, LLC, 2013.

WEB REFERENCES:

1. http://greenteapress.com/wp/think-python/
2. www.docs.python.org
3. https://nptel.ac.in/courses/106/106/106106182/

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OUTCOMES:

Upon completion of the course, the student should be able to

1. Describe the syntax, semantics and control flow statements of Python programming.
2. Determine the methods to create and manipulate strings, lists, dictionaries, tuples and sets.
3. Articulate the concepts of functions, modules and packages in Python.
4. Understand and apply the concepts of files, exception handling, classes and objects.
5. Applying the Problem solving concepts to various applications using Python.

CO - PO, MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	2	2	1	1	-	2	2	-	2
CO2	2	3	3	2	2	1	1	-	2	2	-	2
CO3	3	3	3	2	3	2	1	1	2	2	2	3
CO4	2	3	3	3	3	2	2	1	2	2	2	3
CO5	3	3	3	3	3	2	2	2	3	3	3	3

SEMESTER - II

20BSPH201 SDG NO. 4	PHYSICS OF ELECTRONIC DEVICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquaint the electrical properties of materials.
- To present the principles of semiconductor physics and its applications.
- To educate the properties of magnetic and dielectric materials and their uses.
- To introduce the bipolar junction transistors.
- To explicit the field effect transistors, power and display devices.

UNIT I ELECTRICAL PROPERTIES OF MATERIALS 9

Classical free electron theory - Expression for electrical conductivity - Thermal conductivity expression - Wiedemann-Franz law - Success and failures - electrons in metals - Particle in a three dimensional box - degenerate states - Fermi- Dirac statistics - Density of energy states - Electron in periodic potential- Energy bands in solids - Tight binding approximation - Electron effective mass- concept of hole.

UNIT II SEMICONDUCTOR DIODES 9

Semiconductors - Intrinsic, Extrinsic semiconductor, Carrier concentration, PN junction diode- Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes, Special purpose diodes - Schottky barrier diode, Zener diode, Varactor diode ,Tunnel diode, LASER diode and LDR.

UNIT III MAGNETIC AND DIELECTRIC PROPERTIES OF MATERIALS 9

Magnetism in materials - magnetic field and induction - magnetization - magnetic permeability and susceptibility - types of magnetic materials - microscopic classification of magnetic materials - Ferromagnetism: origin and exchange interaction - saturation magnetization and Curie temperature - Domain Theory - Hysteresis phenomenon - Ferrites. Dielectric materials: Polarization processes - dielectric loss - internal field - Clausius-Mosotti relation - dielectric breakdown.

UNIT IV BIPOLAR JUNCTION TRANSISTOR 9

NPN -PNP -Operations-Early effect-Current equations – Input and Output characteristics of CE, CB, CC - Hybrid -π model - h-parameter model, Ebers Moll Model- Gummel Poon- model, Multi Emitter Transistor.

UNIT V FIELD EFFECT TRANSISTORS, POWER AND DISPLAY DEVICES 9

JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage - Channel length modulation, D- MOSFET, E-MOSFET- Characteristics – Comparison of MOSFET with JFET.Power Devices-UJT, SCR, Diac, Triac, Display Devices-LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Donald A Neaman, "Semi-conductor Physics and Devices", Fourth Edition, TataMcGrawHill Inc.2012.
2. Salivahanan.S, Suresh Kumar. N, Vallavaraj.A, "Electronic Devices and circuits", Third Edition, Tata McGraw- Hill,2008.

REFERENCES:

1. Robert Boylestadand Louis Nashelsky, "Electron Devices and Circuit Theory", Pearson Prentice Hall, 10th edition, July2008.
2. R.S.Sedha, "A Text Book of Applied Electronics" S.Chand Publications, 2006.
3. Yang, "Fundamentals of Semiconductor Devices", McGraw Hill International Edition, 1978.

OUTCOMES:

Upon completion of the course, the student should be able to

1. Understand the electrical properties of materials.
2. Analyse the principles of semiconductor physics and its applications.
3. Explore the properties of magnetic and dielectric materials and their uses.
4. Understand the theory, construction and operation of the bipolar junction transistors.
5. Analyse the concept of field effect transistors, power and display devices.

CO - PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2	1	1	-	3	-	-	1	2	2
CO2	3	2	3	2	3	1	1	-	1	1	-	1	3	3
CO3	3	2	3	3	3	1	1	-	1	-	-	1	3	3
CO4	1	1	3	1	-	-	1	-	2	-	-	-	2	3
CO5	1	2	2	-	1	2	3	1	-	-	-	-	2	3

SEMESTER - II

20ECPC201 SDG NO. 4, 9	CIRCUIT ANALYSIS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of DC and AC circuits behavior.
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- To introduce different methods of circuit analysis using Network theorems, duality and topology.

UNIT I BASIC CIRCUITS ANALYSIS AND NETWORK TOPOLOGY 9

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

UNIT II NETWORK THEOREMS FOR DC AND AC CIRCUITS 9

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

UNIT III RESONANCE AND COUPLED CIRCUITS 9

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

UNIT IV TRANSIENT ANALYSIS 9

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

UNIT V TWO PORT NETWORKS 9

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

TOTAL PERIODS :45

TEXT BOOKS:

1. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", McGraw Hill Science Engineering, 8th Edition, 11th Reprint, 2016.
2. Joseph Edminister and Mahmood Nahvi, "Electric Circuits", Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, 5th Edition Reprint 2016.

REFERENCES:

1. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 5th Edition, McGraw Hill, 9th Reprint, 2015.
2. A.Bruce Carlson, "Circuits: Engineering Concepts and Analysis of Linear Electric Circuits", Cengage Learning, India Edition, 2nd Indian Reprint, 2009.
3. Allan H.Robbins, Wilhelm C.Miller, "Circuit Analysis Theory and Practice", Cengage Learning, 5th Edition, 1st Indian Reprint, 2013.
4. EuoF.F., "Network Analysis and Synthesis", Wiley International Edition, 2nd Edition, 1996.
5. Sudhakar and Shyammohan, "Network Analysis & Synthesis".

WEB RESOURCES:

1. https://www.khanacademy.org/science/electrical-engineering/ee-circuit-analysis-topic

2. http://homepages.wmich.edu/~miller/ECE2100.html
3. https://engineering.purdue.edu/~ee202https://engineering.purdue.edu/~ee202

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc17_ee13/preview
2. https://www.coursera.org/learn/linear-circuits-dcanalysis
3. https://onlinecourses.nptel.ac.in/noc17_ee15/preview
4. https://swayam.gov.in/course/218-networks-and-systems

OUTCOMES:

At the end of the course, the student should be able to

1. Develop the capacity to analyze electrical circuits, apply the circuit theorems in real time.
2. Design, understand and evaluate the AC and DC circuits.
3. Design, understand resonance and to design Resonant circuits.
4. Analyze the response of RL, RC and RLC circuits for standard test signals like step and sinusoidal signals. Understand two port networks and filter synthesis.
5. Gain Hands on experience on Laws, Theorems & transient analysis.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	2	-	-	-	-	2	2	3	2
CO2	3	1	3	2	-	2	-	-	-	-	2	2	3	2
CO3	3	1	3	2	-	2	-	-	-	-	2	2	3	2
CO4	3	1	3	2	3	2	-	-	-	-	2	2	3	2
CO5	3	1	3	2	3	2	-	-	2	3	2	2	3	2

SEMESTER - II

20ESGE201 SDG NO. 4,9,12	ENGINEERING PRACTICES LABORATORY	L 0	T 0	P 3	C 1.5

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic engineering practices in Electrical and Electronics Engineering, Civil and Mechanical Engineering

ELECTRICAL ENGINEERING PRACTICE

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

ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.
2. Study of logic gates AND, OR, EX-OR and NOT.
3. Generation of Clock Signal.
4. Soldering practice – Components, Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

CIVIL ENGINEERING PRACTICE

Buildings:

Study of plumbing and carpentry components of residential and industrial buildings, safety aspects.

Plumbing Works:

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
2. Study of pipe connections requirements for pumps and turbines.

3. Preparation of plumbing line sketches for water supply and sewage works.
4. Hands-on-exercise: Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
5. Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:

1. Study of the joints in roofs, doors, windows and furniture.
2. Hands-on-exercise: Wood work, joints by sawing, planing and cutting.

MECHANICAL ENGINEERING PRACTICE

Welding:

1. Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
2. Gas welding practice.

Basic Machining:

1. Simple Turning and Taper turning.
2. Drilling Practice.

Sheet Metal Work:

1. Forming & Bending.
2. Model making – Trays and funnels.
3. Different type of joints.

Machine assembly practice:

1. Study of centrifugal pump.
2. Study of air conditioner.

Demonstration on:

1. Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
2. Foundry operations like mould preparation for gear and step cone pulley.
3. Fitting – Exercises – Preparation of square fitting and V – fitting models.

Total : 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

1. Electrical

1	Assorted electrical components for house wiring	15 Sets
2	Electrical measuring instruments	10 Sets
3	Study purpose items: Iron box, fan and regulator, emergency lamp	1 Each
4	Megger (250V/500V)	1 No
5	Power Tools: Range Finder Digital Live-wire detector	 2 Nos 2 Nos

2. Electronics

1	Soldering guns	10 Nos
2	Assorted electronic components for making circuits	50 Nos
3	Small PCBs	10 Nos
4	Multimeters	10 Nos

3. Civil

1	Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings.	15 Sets
2	Carpentry vice (fitted to work bench)	15 Nos
3	Standard woodworking tools	15 Sets
4	Models of industrial trusses, door joints, furniture joints	5 each
5	Power Tools: Rotary Hammer Demolition Hammer Circular Saw Planer Hand Drilling Machine Jigsaw	 2 Nos 2 Nos 2 Nos 2 Nos 2 Nos 2 Nos

4. Mechanical

1	Arc welding transformer with cables and holders	5 Nos
2	Welding booth with exhaust facility	5 Nos
3	Welding accessories like welding shield, chipping hammer, wire brush, etc	5 Sets
4	Oxygen and acetylene gas cylinders, blow pipe and other welding outfit.	2 Nos

5	Centre lathe	2 Nos
6	Hearth furnace, anvil and smithy tools	2 Sets
7	Moulding table, foundry tools	2 Sets
8	Power Tool: Angle Grinder	2 Nos
9	Study-purpose items: centrifugal pump, air-conditioner	1 each

OUTCOMES:

Upon completion of the course, the students will be able to

1. Calculate electrical parameters such as voltage, current, resistance and power.
2. Measure the electrical energy by single phase and three phase energy meters.
3. Prepare the carpentry and plumbing joints.
4. Perform different types of welding joints and sheet metal works.
5. Perform different machining operations in lathe and drilling.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	2	1	-	-	1	1	1	1	2	2
CO2	2	2	1	1	1	1	-	-	1	1	1	1	2	2
CO3	1	1	1	-	-	2	-	-	1	1	1	2	1	2
CO4	2	1	1	-	-	1	1	1	1	1	1	2	2	2
CO5	2	1	1	-	-	1	-	1	1	1	1	2	2	2

SEMESTER - II

20ECPL201 SDG NO. 4	CIRCUITS AND DEVICES LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- Analyse the characteristics of basic electronic devices
- Design RL and RC circuits
- Verify KVL & KCL, Thevinin, Norton and Super Position Theorems
- Verify Reciprocity and Maximum Power Transfer Theorem
- Analyse the characteristics of Wave shaping circuits and Rectifier

LIST OF EXPERIMENTS :

1. Characteristics of PN Junction Diode.
2. Zener diode Characteristics & Regulator using Zener diode .
3. Common Emitter input-output Characteristics.
4. Common Base input-output Characteristics.
5. FET Characteristics.
6. SCR Characteristics.
7. Clipper and Clamper & FWR.
8. Verifications of Thevinin & Norton theorem.
9. Verifications of KVL & KCL.
10. Verifications of Super Position Theorem.
11. Verifications of maximum power transfer & reciprocity theorem.
12. Determination of Resonance Frequency of Series & Parallel RLC Circuits.

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:

S.No.	EQUIPMENTS	
1.	BC 107, BC 148, 2N2646, BFW10	- 25 each
2.	1N4007, Zener diodes	- 25 each
3.	Resistors, Capacitors, Inductors	- sufficient quantities
4.	Bread Boards	- 15 Nos
5.	CRO (30MHz)	- 10 Nos
6.	Function Generators (3MHz)	- 10 Nos

OUTCOMES :

On completion of this laboratory course, the student should be able to

1. Demonstrate the VI characteristics of basic electronic devices
2. Construct the RL and RC circuits for transient analysis
3. Verify KVL & KCL, Thevinin, Norton and Super Position Theorems
4. Analyze the frequency response of series and parallel RLC circuits
5. Construct the Wave shaping circuits

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	3	1	-	-	-	-	-	2	3	3	2
CO2	3	3	1	3	1	-	-	-	-	-	2	3	3	2
CO3	3	3	1	3	1	-	-	-	-	-	2	3	3	2
CO4	3	3	1	3	1	-	-	-	-	-	2	3	3	2
CO5	3	3	1	3	1	-	-	-	-	-	2	3	3	2

SEMESTER - II

20ECTE201 SDG NO. 9	PCB DESIGN	L	T	P	C
		0	0	2	1

OBJECTIVES:

- Analyze and interpret test results and measurements on electric circuits
- To predict the performance of electric circuits from device characteristics
- Design an electronic printed circuit board for a specific application using industry standard software

LIST OF EXPERIMENTS :

1. Introduction to PCB and OrCAD software.
2. Designing of schematic.
3. Designing of capture from OrCAD and getting positive for PCB manufacturing.
4. Soldering shop: Fabrication of DC regulated power supply.
5. PCB Lab: (a) Artwork & printing of a simple PCB. (b) Etching & drilling of PCB.

6. Wiring & fitting shop: Fitting of power supply along with a meter in cabinet.
7. Testing of regulated power supply fabricated.

TOTAL: 30 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:

S.No.	EQUIPMENTS	
1.	Copper cladded base board	-15 Nos.
2.	Hand Drilling machine	-15 Nos.
3.	Soldering guns	-15 Nos.
4.	Assorted electronic components for making circuits	-50 Nos.
5.	OrCAD software	(15 users)
6.	Copper solvent	-as required
7.	PCs - 15 Nos	-15 Nos.

OUTCOMES:

On completion of this course, the student should be able to

1. Analyze the fabrication processes of printed circuit boards.
2. Perform the chemical processes by using negative/positive masks.
3. Perform the mechanical processes by using drilling, etching/routing, milling equipments as well as the developer and etcher machines.
4. Operate ORCAD software and design the PCB using ORCAD software.
5. Fabricate and test the PCB for regulated power supply.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	3	2	1	-	-	-	-	2	1	2	2
CO2	2	1	2	3	1	1	-	-	-	-	2	3	2	2
CO3	2	3	2	2	1	1	-	-	-	-	2	2	3	2
CO4	3	2	2	3	3	2	-	-	-	-	2	1	3	2
CO5	3	2	2	3	1	1	-	-	-	-	3	2	2	3

SEMESTER - II

20TPHS201 SDG NO. 4&5	SKILL ENHANCEMENT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the nuances in resume building
- To explore various virtual meeting tools
- To gain knowledge about online certification courses
- To develop knowledge in Google Suite products
- To enhance presentation skills

UNIT I RESUME BUILDING **6**

Your Strength, Projects, Internship, Paper Presentation, uploading your coding in github, Introduction to HackerRank, HackerEarth virtual online assessment (Auto Proctored) (Practicals - Construct a resume, Register for a online Mock Assessment / Contest)

UNIT II VIRTUAL MEETINGS **6**

Basic Etiquette of virtual meeting – Introduction to Skype - Zoom - Webex - Google Meet - Gotowebinar - Jio meet – Screen Share - Jamboard - Feedback polling - Chatbox

(Practicals - Accept and Register for a mock class to attend - How to host a meeting).

UNIT III ONLINE LEARNING **6**

Online Certification - Coursera – Udemy – Edx – Cisco – Online Practice Platforms - SkillRack – Myslate - FACEprep - BYTS - aptimithra - Contest Registrations - TCS Campus Commune - HackwithInfy, InfyTQ - Virtusa NurualHack - Mindtree Osmosis – Online assessment - AMCAT-PGPA.

(Practicals - Campus Commune Registration , Coursera registration - Mock Registration (KAAR Technologies as sample).

UNIT IV GOOGLE SUITE **8**

Define google suite - Benefits of google suite - Google Search - Sheet - Docs - Forms - Calender - Drive - Slide - Translate - Duo - Earch - Maps - Hangouts- Sites - Books - Blogger

(Practicals – Create google sheets and share - Create google Forms and share, Create Google Slide and share , Google drive creation and share (Knowledge of Rights), Create poll and share.

UNIT V PRESENTATION SKILLS **4**

Email Writing – Group Discussion - Power Point Presentation

(Practicals- Create a self SWOT Analysis report. A PowerPoint Slide Preparation)

TOTAL : 30 PERIODS

WEB REFERENCES :

Unit I: Resume Building:

1. https://zety.com/blog/resume-tips
2. https://resumegenius.com/blog/resume-help/how-to-write-a-resume
3. https://www.hackerearth.com/recruit/
4. https://www.hackerrank.com/about-us

Unit – II:Virtual Meetings

1. https://www.claphamschool.org/our-community/blog/online-learning-etiquette-guide-14-principles-to-guide-students
2. https://online.hbs.edu/blog/post/virtual-interview-tips?c1=GAW_SE_NW&source=IN_GEN_DSA&cr2=search__-__nw__-__in__-__dsa__-__general&kw=dsa__-__general& cr5=459341920955&cr7=c&gclid=Cj0KCQjw8fr7BRDSARIsAK0Qqr4dRRbboL3kltrwDsr7hm8oIHtN5dfjD3NIFZULuzNwEXxhjpNFQ2caApn5EALw_wcB
3. https://hygger.io/blog/top-10-best-group-meeting-apps-business/
4. https://www.zdnet.com/article/best-video-conferencing-software-and-services-for-business/

Unit – III:Online Learning

1. https://www.coursera.org/browse
2. https://support.udemy.com/hc/en-us/articles/229603868-Certificate-of-Completion
3. https://www.edx.org/course/how-to-learn-online
4. https://www.cisco.com/c/en/us/training-events/training-certifications/certifications.html
5. https://campuscommune.tcs.com/en-in/intro
6. https://www.freshersnow.com/tcs-campus-commune-registration/
7. https://www.infosys.com/careers/hackwithinfy.html
8. https://www.mindtree.com/blog/osmosis-2013-my-experiences
9. https://www.myamcat.com/knowing-amcat
10. https://www.admitkard.com/blog/2020/02/06/amcat/

Unit IV: Google Suite

1. https://www.inmotionhosting.com/blog/what-is-g-suite-and-why-should-i-consider-using-it/
2. https://en.wikipedia.org/wiki/G_Suite
3. https://blog.hubspot.com/marketing/google-suite
4. https://kinsta.com/blog/g-suite/

Unit V: Presentation Skills

1. https://www.mindtools.com/CommSkll/EmailCommunication.htm
2. https://www.grammarly.com/blog/email-writing-tips/
3. https://business.tutsplus.com/articles/how-to-write-a-formal-email--cms-29793
4. https://www.softwaretestinghelp.com/how-to-crack-the-gd/
5. https://www.mbauniverse.com/group-discussion/tips
6. https://slidemodel.com/23-powerpoint-presentation-tips-creating-engaging-interactive-presentations/
7. https://business.tutsplus.com/articles/37-effective-powerpoint-presentation-tips--cms-25421
8 https://blog.prezi.com/9-tips-on-how-to-make-a-presentation-a-success/
9. http://www.garrreynolds.com/preso-tips/design/

OUTCOMES:

On completion of this course, the student should be able to

1. Construct a suitable resume and registration procedure for online mock assessments
2. Handle various virtual meeting tools
3. Acquire exposure about online certification courses
4. Get involved and work in a collaborative manner
5. Gain knowledge in various presentation methodologies

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	3	2	-	3	2	3	-	2
CO2	-	-	-	-	3	2	-	3	2	3	-	2
CO3	-	-	-	-	3	2	-	-	1	3	-	2
CO4	-	-	-	-	3	2	-	3	3	3	-	2
CO5	-	-	-	-	3	2	-	-	2	3	-	2

SEMESTER - II

20HSMG201 SDG NO. 4 & 5	INTERPERSONAL VALUES	L	T	P	C
		2	0	0	0

OBJECTIVES:

- Values through Practical activities

UNIT I INTERPERSONAL VALUES **6**

Interpersonal Relationships and Values – Importance and Barriers – Building and maintain relationships – Mutual understanding – Respect to others.

UNIT II EFFECTIVE COMMUNICATION **6**

Communication skills –Importance and Barriers - Impressive formation and management – Public speaking

UNIT III GROUP DYNAMICS **6**

Group formation –Teamwork – Identify others attitude and behaviour – Formation of relationship – Personal and professional.

UNIT IV MUTUAL RELATIONSHIP **6**

Building mutual understanding and cooperation – Enhancing decision making skills – Problem solving skills – Comparative Appraisal – Interpersonal needs.

UNIT V POSITIVE ATTITUDE **6**

Fostering trust and cooperation – Developing and maintain positive attitude – Improving socialization – Development of security and comfort.

TOTAL: 30 PERIODS

Note: Each topic in all the above units will be supplemented by practice exercises and classroom activities and projects.

REFERENCE BOOKS:

1. Barun K. Mitra, "Personality Development and Soft Skills", Oxford University Press, 2016.
2. B.N.Ghosh, "Managing Soft Skills for Personality Development", McGraw Hill India, 2012.

OUTCOMES:

Upon completion of the course, the student should be able to

1. Develop a healthy relationship & harmony with others.
2. Practice respecting every human being.
3. Practice to eradicate negative temperaments.
4. Acquire Respect, Honesty, Empathy, Forgiveness and Equality.
5. Manage the cognitive abilities of an Individual.

CO – PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	2	3	3	1	1	1
CO2	-	-	-	-	-	2	2	3	3	1	1	1
CO3	-	-	-	-	-	2	2	3	3	1	1	1
CO4	-	-	-	-	-	2	2	3	3	1	1	1
CO5	-	-	-	-	-	2	2	3	3	1	1	1

SEMESTER - III

20ECPC301 SDG NO. 4, 9	DIGITAL ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions.
- To introduce the methods for simplifying Boolean expressions.
- To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits.
- To introduce the concept of memories and programmable logic devices.
- To illustrate the concept of synchronous and asynchronous sequential circuits.

UNIT I LOGIC SIMPLIFICATION 9

Review of number systems and number representation – Binary codes – Code Conversion; Logic Simplification: Review of Boolean Algebra and De Morgan's Theorem – SOP and POS forms – Canonical forms – Karnaugh maps up to 5 variables- QuineMcClusky method - Implementation using logic gates

UNIT II COMBINATIONAL LOGIC DESIGN 9

Design of Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder – Carry look ahead Adder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Flip- Flops: Bistable elements, Latches, Flip-Flops, Flip flops – SR, JK, T, D,– operation and excitation tables, Triggering of FF- Master/Slave FF.

Registers and Counters: Shift registers -SISO, SIPO, PISO and PIPO, Universal Shift Register; up/down Counters; Design of Synchronous counters, Modulus-n Counter - Shift Register Counters -Ring Counters and Johnson Counter.

Clocked Sequential circuit: Analysis of clocked sequential circuits – concept of state – state diagram - state table, state reduction procedures by partitioning and implication chart-Moore/Mealy models; Design of synchronous sequential circuits- Serial Adder- Sequence detector.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Introduction to asynchronous sequential circuits - fundamental mode and pulse mode circuits - State Diagram and Excitation Table - Ripple Counters-cycles and races, state reduction, race free assignments, –Pulse mode

sequential circuits- Design. Hazards, Essential Hazards, Design of Hazard free circuits

UNIT V MEMORY DEVICES AND PROGRAMMABLE LOGIC DEVICES 9

Memory Devices: Basic memory structure – ROM - PROM – EPROM – EEPROM –EAPROM, RAM – Static and dynamic RAM.

PLDs: PLA, PAL, PROM, Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL. – CPLD. Field Programmable Gate Arrays (FPGA).

Digital integrated circuits: Logic levels, propagation delay, power dissipation, fan-out and fan-in, noise margin, logic families and their characteristics-RTL, TTL, ECL, CMOS.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 5th Edition, Pearson, 2014.
2. S. Salivahanan, S. Arivazhagan, "Digital Circuits and Design", Oxford Press India, 2018 (5th Edition).
3. R P Jain, "Modern Digital Electronics", McGraw Hill India, 2009 (4th Edition).

REFERENCES:

1. Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
2. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011.
3. S.Salivahanan and S.Arivazhagan, "Digital Electronics", Ist Edition, Vikas Publishing House pvt Ltd, 2012.
4. Anil K.Maini, "Digital Electronics", Wiley, 2014.
5. A.Anand Kumar, "Fundamentals of Digital Circuits", 4th Edition, PHI Learning Private Limited, 2016.
6. Soumitra Kumar Mandal, "Digital Electronics", McGraw Hill Education Private Limited, 2016.
7. Donald P Leach, Albert Paul Malvino and GoutamSaha, "Digital Principles and Applications" McGraw Hill, India – 2014 (8th Edition – SIE).

WEB REFERENCES:

1. http://nptel.ac.in/courses/117106086/1
2. http://web.iitd.ac.in/~shouri/eel201/lectures.php

3. https://www.allaboutcircuits.com/textbook/digital/
4. http://nptel.ac.in/courses/117103064/

ONLINE RESOURCES:

1. https://www.adelaide.edu.au/course-outlines/108280/1/sem-2/ - University of Adelaide
2. http://jjackson.eng.ua.edu/courses/ece480/- The University of Alabama
3. http://www.ee.ic.ac.uk/pcheung/teaching/ee2_digital/index.html - Imperial College London

OUTCOMES:

Upon completion of the course, the student should be able to

1. Utilize Boolean algebra and K-map as tool and the knowledge of number systems and codes, to simplify and design logic circuits.
2. Design and analyze the operation of Combinational Circuits from the description of a logical function.
3. Design and analyze the operation of Synchronous Sequential Circuits from the description of a logical function.
4. Design and analyze the operation of Asynchronous Sequential Circuits from the description of a logical function.
5. Describe the function, characteristics and structure of different memory systems, programmable logic devices.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	2	-	-	-	1	-	-	-	2	3	2
CO2	3	3	3	3	-	-	-	1	2	2	-	2	3	2
CO3	2	2	3	3	-	-	-	-	2	2	-	1	3	2
CO4	3	1	2	1	-	-	-	2	1	1	-	1	3	2
CO5	3	2	3	1	-	-	-	1	2	1	-	1	3	2

SEMESTER - III

20ECPC302 SDG NO. 3,4,7,15	ELECTROMAGNETIC FIELDS AND WAVEGUIDES	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To gain conceptual and basic mathematical understanding of electric and magnetic fields in free space and in materials
- To understand the coupling between electric and magnetic fields through Faraday's law, displacement current and Maxwell's equations
- To understand wave propagation in lossless and in lossy media
- To be able to solve problems based on the above concepts
- To understand signal propagation at Radio frequencies and analyse the Rectangular and circular waveguides

UNIT I INTRODUCTION **9**

Electromagnetic model, Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Line, surface and volume integrals, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem.

UNIT II ELECTROSTATICS **9**

Electric charge, Coulomb's law, Electric field due to Line, Surface, Volume charge densities, Electric flux, Electric flux density, Gauss's law and applications, Electric potential, Potential gradient-Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Capacitance, Parallel, cylindrical and spherical capacitors, Electrostatic energy and energy density, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Point form of Ohm's law, Electromotive force and Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law .

UNIT III MAGNETOSTATICS **9**

Lorentz force equation, Law of no magnetic monopoles, Ampere's law, Biot-Savart law and applications, Magnetic field intensity, Magnetic flux density, Gauss's law, Magnetic vector potential, Lorentz force equation, Boundary conditions and idea of relative permeability, Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors,

Magnetic energy and Magnetic energy density, Magnetic forces and torques Applications – CRT – magnetic deflection, Magnetic brake, Linear motor, Time Varying Field: Induction, Faraday's law, Lenz's law.

UNIT IV TIME-VARYING FIELDS AND MAXWELL's EQUATIONS 9

Faraday's law, Lenz's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector.

UNIT V WAVEGUIDES 9

Introduction to Rectangular and Circular Waveguides, Solutions of field Equations in Rectangular Co-ordinates, TEmn & TMmn Modes in Rectangular Waveguides, solutions of a field equations in cylindrical coordinates, TEmn & TMmn Modes in Circular Waveguides, Impossibility of TEM waves in Rectangular wave guides, Waveguide Parameters — Cut-off wavelength, Guide wavelength, Free space Wavelength, Phase velocity, Group velocity, Dominant and Degenerated Modes, Power Transmission and Power losses in Rectangular and Circular Waveguides

TOTAL : 45 PERIODS

TEXT BOOKS

1. D.K. Cheng, "Field and Wave Electromagnetics", 2nd Edition, Pearson (India), 1989. (UNIT I - IV).
2. John. D. Ryder, "Network Lines and Fields", 2nd Edition, PHI Learning,2005. (Unit V).

REFERENCES:

1. D.J. Griffiths, "Introduction to Electrodynamics", 4th Edition, Pearson (India), 2013.
2. M.N.O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", 6th Edition, Oxford (Asian Edition), 2015.
3. E. C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", Prentice Hall of India, 2006.

WEB RESOURCES :

1. https://ocw.mit.edu/resources/res-6-002-electromagnetic-field-theory-a-problem-solving-approach-spring-2008/textbook-contents/

ONLINE RESOURCES :

1. https://freevideolectures.com/course/2340/electromagnetic-fields
2. https://ocw.mit.edu/resources/res-6-001-electromagnetic-fields-and-energy-spring-2008/index.htm

OUTCOMES:

Upon completion of the course, the student should be able to

1. Apply mathematical knowledge to solve electrostatics and magneto statics equations.
2. Interpret Maxwell's equations for time dependent electromagnetic fields.
3. Analyze the boundary conditions of electric and magnetic field and determine the capacitance and inductance of various geometries.
4. Distinguish Linear, circular and elliptical polarization with right and left orientation.
5. Analyze the Concept of propagating modes, TE and TM decomposition, evanescent modes and cutoff frequency in waveguides.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	1	1	-	1	1	3	2
CO2	3	2	2	-	-	-	-	1	1	-	1	1	3	2
CO3	3	2	2	-	-	-	-	1	1	-	1	1	3	2
CO4	3	2	2	-	-	-	-	1	1	-	1	1	3	2
CO5	3	2	2	-	-	-	-	1	1	-	1	1	3	2

SEMESTER - III

20ECPC303 SDG NO. 3,4,11	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To understand the fundamentals and properties of signal & systems
- To know the methods of characterization of LTI systems in time domain and frequency domain
- To analyze continuous time signals and system using Fourier and Laplace transforms
- To analyze discrete time signals and system using Fourier and Z transforms
- To analyze analog and discrete time systems, connected in series and parallel

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

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

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Fourier series representation of continuous time periodic signals - properties of continuous time Fourier series, Fourier Transform of continuous time aperiodic signals and periodic signals, properties of continuous time Fourier transform - Laplace Transforms and properties.

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 9

Impulse response - convolution integrals- Properties of continuous time LTI system - Differential Equation- Causal continuous time LTI system described by differential equations -Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Baseband signal Sampling – properties of discrete time LTI system, Causal discrete time LTI system described by difference equations. Fourier series representation of discrete time periodic signals, properties of discrete time

Fourier series, Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties.

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson, 2015. (Unit 1- V).

REFERENCES:

1. B. P. Lathi, "Principles of Linear Systems and Signals", Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, "Signals & Systems - Continuous and Discrete", Pearson, 2007.
3. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.

WEB REFERENCES:

1. https://www.tutorialspoint.com/signals_and_systems/index.htm

ONLINE RESOURCES:

1. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/assignments/

OUTCOMES:

Upon completion of the course, the student should be able to

1. Represent basic continuous and discrete time signal and systems.
2. Explain signal properties such as periodic – non periodic, odd – even, energy – power and systems properties such as causality, linearity, time variance and invariance.
3. Find the response of an LTI system for a given continuous and Discrete time input signal in time domain and frequency domain.
4. Convert a continuous time signal to discrete time signal and reconstruct the continuous time signal.

5. Analyze and characterize LTI systems using, Fourier Transform, Laplace Transform and Z Transform.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	1	-	-	-	-	-	-	1	3	2
CO2	3	2	2	-	1	-	-	-	-	-	-	1	3	2
CO3	3	2	2	-	1	-	-	-	-	-	-	1	3	2
CO4	3	2	2	-	1	-	-	-	-	-	-	1	3	2
CO5	3	2	2	-	1	-	-	-	-	-	-	1	3	2

SEMESTER - III

20ECPW301 SDG NO. 4 & 9	R PROGRAMMING WITH LABORATORY	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To Understand the environment of R programming
- To obtain knowledge in the various structural aspects of R
- To utilize the libraries in the R programming for various mathematical functions
- To use the libraries for real time analysis of data and its plotting prospects
- To study the basics of machine learning and its implementation using R

UNIT I INTRODUCTION **9**

Introduction, How to run R, R Sessions, and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT II BASIC OF R PROGRAMMING **9**

R Programming Structures, Control Statements, Loops, Looping Over Nonvector Sets, If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary SearchTree.

UNIT III MATHEMATICAL RELATIONS IN R 9

Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima-Calculus, Functions For Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product-Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files.

UNIT IV VISUALISATION USING AND BASICS OF MACHINE LEARNING 9

Graphics, Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files. Machine learning-Introduction- Classifications- Supervised learning-unsupervised learning-reinforcement learning- Algorithms- Case studies

UNIT V STATISTICAL MODELS AND ITS IMPLEMENTATION 9

Probability Distributions, Normal Distribution- Binomial Distribution-Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests, ANOVA. Linear Models, Simple Linear Regression, Multiple Regression Generalized Linear Models, Logistic Regression, Poisson Regression-other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests.

R PROGRAMMING LAB-LIST OF EXPERIMENTS: 15

1. Datatypes
2. Functions
3. Creating and manipulating a vector
4. Creating and manipulating matrix
5. Creating and operations on Factors
6. Data Frames-Lists-Operators-PLOT Function in R to customize graphs.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. The Art of R Programming, Norman Matloff, CengageLearning.
2. Siegel, S. (1956), Nonparametric Statistics for the Behavioral Sciences, McGraw-Hill International, Auckland.

REFERENCES:

1. Lander, "R for Everyone", Pearson
2. Venables, W. N., and Ripley, B. D. (2000), "S Programming", Springer-Verlag, NewYork.

3. Weisberg, S. (1985), "Applied Linear Regression", 2nd ed., John Wiley & Sons, NewYork.
4. Zar, J. H. (1999), "Biostatistical Analysis", Prentice Hall, Englewood Cliffs,NJ

WEB REFERENCES:

1. https://www.cs.upc.edu/~robert/teaching/estadistica/rprogramming.pdf.
2. https://link.springer.com/content/pdf/10.1007%2F978-0-387-79054-1.pdf3.https://link.springer.com/content/pdf/10.1007%2F978-0-387-93837-0.pdf

ONLINE RESOURCES:

1. https://www.statmethods.net/r-tutorial/index.html
2. https://www.javatpoint.com/r-tutorial

OUTCOMES:

Upon completion of the course, the student should be able to

1. List motivation for learning a programming language.
2. Access online resources for R and import new function packages into the R workspace.
3. Import, review, manipulate and summarize data-sets in R.
4. Explore data-sets to create testable hypotheses and identify appropriate statistical tests.
5. Perform appropriate statistical tests using R Create and edit visualizations with R.

CO - PO - PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	2	-	-	-	-	2	2	3	2
CO2	3	1	3	2	-	2	-	-	-	-	2	2	3	2
CO3	3	1	3	2	-	2	-	-	-	-	2	2	3	2
CO4	3	1	3	2	2	2	-	-	-	-	2	2	3	2
CO5	3	1	3	2	2	2	-	-	-	-	2	2	3	2

SEMESTER - III

20BSMA301 SDG NO. 4	LINEAR ALGEBRA, PARTIAL DIFFERENTIAL EQUATIONS AND TRANSFORMS	L	T	P	C
		3	1	0	4

OBJECTIVES:

- The aim of this course is to impart knowledge in the concepts of linear algebra as a prerequisite for the recent thrust areas of technological advancement
- To know the importance of partial differential equations in modeling various engineering problems
- To introduce the techniques of Fourier and Z- Transforms to analyze continuous and discrete signals

UNIT I VECTOR SPACES 15

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

UNIT II LINEAR TRANSFORMATION AND INNER PRODUCT SPACES 15

Linear transformation - Null and range spaces - Dimension theorem (Statement only) - Matrix of a linear transformation - Inner product - norm - Gram Schmidt orthogonalization process.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 12

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Integral surface passing through a given curve–Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT IV FOURIER TRANSFORMS 9

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL: 60 PERIODS

TEXTBOOKS:

1. Friedberg A.H., Insel A.J. and Spence L., "Linear Algebra", Prentice Hall of India, New Delhi, 2004. Unit I (Sec. 1.2, 1.3, 1.4 (linear combinations only), 1.5 & 1.6), Unit II (Sec. 2.1, 2.2, 6.1 & 6.2) (In Units I & II to include theorem statements only).
2. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., 3rd Edition, New Delhi. Unit III (Sec. 1.2, 1.5, 1.7, 1.11, 1.13, 1.14), Unit IV (Sec. 4.1, 4.2, 4.3, 4.6), Unit V(Sec. 5.1, 5.2, 5.3, 5.4, 5.5).

REFERENCES:

1. Strang G., "Linear Algebra and its applications", Thomson (Brooks/Cole), New Delhi, 2005.
2. Lay D. C., "Linear Algebra and its Applications", 5th Edition, Pearson Education, 2015.
3. Kumaresan S., "Linear Algebra – A Geometric Approach", Prentice – Hall of India, New Delhi, Reprint, 2010.
4. James G., "Advanced Modern Engineering Mathematics", Pearson Education, 2007.

WEB RESOURCES

1. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/
2. https://nptel.ac.in/courses/111/106/111106135/
3. https://nptel.ac.in/courses/111/103/111103021/

ONLINE RESOURCES:

1. https://www.khanacademy.org/math/linear-algebra
2. https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/
3. https://freevideolectures.com/course/3244/advanced-engineering-mathematics

OUTCOMES:

Upon completion of the course, the students should be able to

1 Identify a vector space, subspace and construct the basis and dimension of a vector space.

2 Compute the matrix of a linear transformation and construct orthonormal bases using Gram Schmidt process.

3 Find the solutions of various Partial Differential Equations that occur in Engineering Problems.

4 Apply Fourier Transform techniques in solving problems arising in various domains of Engineering.

5 Solve problems in discrete time systems using Z-transform techniques.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	1	1	-	-	-	-	-	1	1
CO2	3	3	2	1	1	-	-	-	-	-	1	1
CO3	3	3	2	1	1	-	-	-	-	-	1	1
CO4	3	3	2	1	1	-	-	-	-	-	1	1
CO5	3	3	2	1	1	-	-	-	-	-	1	1

SEMESTER - III

20ECPL301 SDG NO. 3,4,9	DIGITAL CIRCUITS LAB	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- Get practical experience in design, realisation and verification of Demorgan's Theorem
- Design Full/Parallel Adders and Subtractors
- Design and learn Multiplexer using logic gates, Demultiplexer and Decoder
- Verify the function of Flip-Flops
- Design Shift registers and Counters using Flip flops

LIST OF ANALOG EXPERIMENTS:

1. To realize Basic gates (AND,OR,NOT) From Universal Gates(NAND & NOR).
2. To verify
   (a) Demorgan's Theorem for 2 variables
   (b) The sum-of product and product-of-sum expressions using universal gates
3. To design and implement 4-bit Parallel Adder/ subtractor using IC 7483

4. To realize (a) 4:1 Multiplexer using gates
   (b) 3-variable function using IC 74151 (8:1 MUX)
5. To realize (a) 1:8 Demultiplexer and
   (b) 3:8 Decoder using IC74138
6. To design 4 bit comparator circuit using logic gates
7. To realize the following flip-flops using NAND Gates:
   (a) Clocked SR Flip-Flop
   (b) JK Flip-Flop
8. To realize the following shift registers using IC7474:
   (a) SISO (b) SIPO
   (c) PISO (d) PIPO
9. To realize the Ring Counter and Johnson Counter using IC7476
10. To realize the Mod-N Counter using IC7490
11. To design 4 bit synchronous Counter using JK Flip flops - IC7476
12. To design 4 bit Ripple counter using JK Flip flops - Ic7476

TOTAL: 45 PERIODS

LAB REQUIREMENT FOR A BATCH OF 30 STUDENTS / 2 STUDENTS PER EXPERIMENT:

S.No.	EQUIPMENTS
1.	IC7404, IC7408, IC 7432, IC7486, IC 7400 & IC 7402
2.	IC 7483- 4 bit Parallel Adder/ Subtractor
3.	IC 7476- JK Flip flops
4.	IC 7474- D Flip flops
5.	Digital Trainer Kit- 15 Nos

VIRTUAL LAB:

1. http://vlabs.iitkgp.ernet.in/dec/
2. http://cse15-iiith.vlabs.ac.in/Introduction.html

OUTCOMES:

On completion of this laboratory course, the student should be able to

1. Design, Test and Evaluate various combinational circuits such as adders and subtractors.
2. Design, Test and Evaluate various combinational circuits comparators, multiplexers and de-Multiplexers.
3. Construct flips-flops using NAND gates and verify their functionality.

4. Construct synchronous and asynchronous counters and verify their functionality.
5. Construct the types of shift registers and verify their functionality.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	1	2	-	-	-	3	3
CO2	3	3	2	3	-	-	-	1	2	-	-	-	3	3
CO3	3	3	2	3	-	-	-	1	2	-	-	-	3	3
CO4	3	3	2	3	-	-	-	1	2	-	-	-	3	3
CO5	3	3	2	3	-	-	-	1	2	-	-	-	3	3

SEMESTER - III

20ECTE301 SDG NO. 4,11,15	LIVE-IN-LAB PROJECT-I (MACHINE LEARNING)	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide opportunities for the students, expose to Industrial environment and real time work
- To enable hands-on experience in the electronics hardware/Software domain
- To enable development of skill set for designing and realizing prototype electronic systems/simulation model

COURSE METHODOLOGY

- This initiative is designed to inculcate ethical principles of research and to get involve in life-long learning process for the students.
- The project work must involve engineering design with realistic constraints. It must also include appropriate elements of the following: Engineering standards, design analysis, modeling, simulation, experimentation, prototyping, fabrication, correlation of data, and software development.

- Project can be individual work or a group project, with maximum of 3 students. In case of group project, the individual project report of each student should specify the individual's contribution to the group project.
- On completion of the project, the student shall submit a detailed project report. The project should be reviewed and the report shall be evaluated and the students shall appear for a viva-voce oral examination on the project approved by the Coordinator and the project guide.

EVALUATION

- First evaluation (Immediately after first internal examination) : 20 marks
- Second evaluation (Immediately after second internal examination): 30marks
- Final evaluation Last week of the semester) : 50marks

Note: All the three evaluations are mandatory for course completion and for awarding the final grade

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to

1. Able to conduct literature survey to identify the gap and an application oriented research problem in the specific domain.
2. Able to design and validate the proposed system using simulation.
3. Able to prototype the proposed system.
4. Able to analyze the obtained results and prepare a technical report.
5. Able to publish the work in journals and apply for the patents.

CO- PO & PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO4	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - III

20MGMC301 SDG NO. 4	CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	0

OBJECTIVES:

At the end of the course, the student is expected to

- To know about Indian constitution
- To know about central government functionalities in India
- To know about state government functionalities in India
- To know about Constitution function
- To Know about Constitutional remedies

UNIT I INTRODUCTION **6**

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties

UNIT II STRUCTURE AND FUNCTION OF CENTRAL GOVERNMENT **6**

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India.

UNIT III STRUCTURE AND FUNCTION OF STATE GOVERNMENT **6**

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV CONSTITUTION FUNCTIONS **6**

Indian Federal System – Centre – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries.

UNIT V CONSTITUTIONAL REMEDIES **6**

Enforcement of fundamental rights - Power of parliament to modify the rights the conferred by this part in their application to forces.

TOTAL: 30 PERIODS

TEXT BOOKS:

1. Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.

2. R.C. Agarwal, (1997) "Indian Political System", S. Chand and Company, New Delhi.
3. M.V. Pyle (2019) , "An Introduction to The Constitution of India, 5/e", Vikas Publishing, New Delhi.
4 P.M. Bakshi, (2018) , "Constitution of India", Universal Law Publishing, New Delhi.

REFERENCES:

1. Sharma, Brij Kishore, "Introduction to the Constitution of India: Prentice Hall of India, New Delhi.
2. U.R.Gahai, "Indian Political System", New Academic Publishing House, Jalandhar.

OUTCOMES:

Upon completion of the course, the student should be able to

1. Understand about constitution & Fundamental rights of citizens.
2. Interpret the structure and hierarchy of central and state Government.
3. Analyze the functions of judiciary, Parliament and its constituent members.
4. Evaluate the functions and boundaries of central and state governments in respect of their powers, duties and centre, state relationship.
5. Distinguish Indian social structure in respect of caste, religion, language, rights to citizens particularly rights to women, children and weaker sections.

CO – PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-		-	-	-	-	1	-	-	-	-	-
CO2	-	-	-	-	-	-	1	-	-	-	-	-
CO3	-	-	-	-	-	-	1	-	-	-	-	-
CO4	-	-	-	-	-	-	1	-	-	-	-	-
CO5	-	-	-	-	-	-	2	-	3	-	-	-

SEMESTER - IV

20ECPC401 SDG NO. 4	COMMUNICATION THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts of various amplitude modulations and their spectral characteristics
- To study the concepts of various angle modulation and their spectral characteristics
- To understand the properties of random process
- To know the effect of noise on communication systems
- To study the fundamentals of sampling, quantization and pulse modulation techniques

UNIT I AMPLITUDE MODULATION 9

Elements of Communication systems – Communication Channels – Need for Modulation - Amplitude Modulation- DSBSC, DSBFC, SSB, ISB, VSB - Modulation index, Spectra, Power relations and Bandwidth of AM – AM Generation – Square law and Switching modulator, DSBSC Generation – Balanced and Ring Modulator, SSB Generation – Filter, Phase Shift and Third Methods, VSB Generation – Filter Method, Hilbert Transform, Pre-envelope & complex envelope –comparison of different AM techniques, AM Demodulators: Envelope Detector, Coherent Detection of DSB – SC, SSB – SC – Costas Receiver – Frequency Translation - Superheterodyne Receiver.

UNIT II ANGLE MODULATION 9

Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Power relations and Transmission Bandwidth of FM – PM to FM Conversion – and FM to PM Conversion – FM Generation: Direct and Indirect methods, FM Demodulation – FM to AM conversion, FM Discriminator – Balanced Slope Detector, Foster Seeley Discriminator, Ratio Detector, PLL Demodulator, Quadrature FM Demodulator – FM Receivers.

UNIT III RANDOM PROCESS 9

Random variables, Random Process, Stationary Processes, Mean, Correlation & Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random Process Through a LTI filter.

UNIT IV NOISE CHARACTERIZATION 9

Noise sources – Noise figure, noise temperature and noise bandwidth – Noise in cascaded systems. Representation of Narrow band noise –In-phase and quadrature components, Envelope and Phase Components – Noise performance analysis in AM & FM systems – Threshold effect, Pre-emphasis and deemphasis for FM.

UNIT V SAMPLING & QUANTIZATION 9

Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Logarithmic Companding –PAM, PPM, PWM, PCM – TDM, FDM.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems", Pearson Education, 2014. (UNIT I-IV)
2. Simon Haykin, "Communication Systems", 4th Edition, Wiley, 2014. (UNIT I-V)

REFERENCES:

1. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press, 2007.
2. D.Roody, J.Coolen, "Electronic Communications", 4th Edition, PHI, 2006.
3. A.Papoulis, "Probability, Random variables and Stochastic Processes", McGraw Hill, 3rd Edition, 1991.
4. B.Sklar, "Digital Communications Fundamentals and Applications", 2nd Edition, Pearson Education, 2007.
5. H P Hsu, "Schaum Outline Series – Analog and Digital Communications", TMH, 2006.
6. Couch.L., "Modern Communication Systems", Pearson, 2001.

WEB REFERENCES :

1. https://swayam.gov.in/nd1_noc20_ee16/preview
2. https://nptel.ac.in/courses/117102059/

ONLINE RESOURCES:

1. https://freevideolectures.com/course/2590/introduction-to-communication-theory

OUTCOMES:

At the end of the course, the student should be able to

1. Illustrate DSB-FC, DSB-SC, SSB-SC, VSB amplitude modulation techniques and their spectrum and explain the function of linear and non-linear AM modulators and demodulators.
2. Illustrate angle modulation techniques and their spectrum and explain the functional blocks of FM modulators and demodulators.
3. Apply the concepts of Random Process to the design of Communication systems.
4. Express narrow band noise using I & Q components & estimate the performance of AM and FM.
5. Describe the fundamentals of sampling, Quantization and Pulse analog modulation techniques.

CO - PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	2	-	-	-	-	2	2	3	2
CO2	3	1	3	2	-	2	-	-	-	-	2	2	3	2
CO3	3	1	3	2	-	2	-	-	-	-	2	2	3	2
CO4	3	1	3	2	3	2	-	-	-	-	2	2	3	2
CO5	3	1	3	2	3	2	-	-	2	3	2	2	3	2

SEMESTER - IV

20ECPW401 SDG NO. 4	ELECTRONIC CIRCUITS WITH LABORATORY	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To understand the methods of biasing BJT
- To design and analyze single stage and multistage amplifier circuits
- To impart knowledge about feedback amplifiers and oscillators
- To inculcate knowledge about tuned amplifier
- Explore the characteristics of Power amplifier

UNIT I BIASING **9**

Need for biasing - DC load line analysis of biasing circuits - Operating point- Design of biasing circuits: Fixed bias configuration, Emitter bias configuration, Voltage divider bias configuration- Bias stabilization - Stability factors.

UNIT II SINGLE AND MULTI STAGE AMPLIFIERS 9

AC load line - BJT small signal model- Analysis of CE, CB, CC amplifier-Gain and frequency response-MOSFET small signal model-Analysis of CS and Source follower-Gain and frequency response-High frequency analysis-Need of multistage amplifier-Cascade, Cascode and Differential amplifier.

UNIT III FEEDBACK AMPLIFIERS AND OSCILLATORS 9

Basic principles and types of feedback-Gain of an amplifier employing feedback-Effect of feedback (negative) on gain, stability, distortion and bandwidth of an amplifier. Voltage series, voltage shunt, Current series and current shunt Feedback configurations. Use of positive feedback-Barkhausen criterion for oscillations-Different oscillator circuits-tuned collector-Hartley, Colpitts, Phase shift, Wien Bridge and Crystal oscillator.

UNIT IV TUNED AMPLIFIERS AND MULTIVIBRATORS 9

Small signal tuned amplifiers – Analysis of capacitor coupled single tuned amplifier – double tuned amplifier - effect of cascading single tuned and double tuned amplifiers on bandwidth – Stagger tuned amplifiers - Stability of tuned amplifiers – Neutralization - Hazeltine neutralization method.

Analysis and Design of Bistable, Monostable, Astable, Multivibrators and Schmitt Trigger using Transistors.

UNIT V LARGE SIGNAL AMPLIFIERS 9

Difference between voltage and Power amplifier- Importance of impedance matching in amplifiers- Class A, Class B, Class AB and Class C amplifiers-Single ended power amplifiers-Push pull amplifier and Complementary symmetry push-pull amplifier.

LIST OF EXPERIMENTS : 15

1. Frequency Response of CE, CB, CC and CS amplifiers.
2. Cascode and Cascade amplifiers.
3. Analysis of frequency response FET, MOSFET with fixed bias, self-bias and voltage divider bias using simulation software using spice.
4. Analysis of Cascode and Cascade amplifiers using Spice.
5. Analysis of Frequency Response of BJT and FET using Spice.
6. Series and Shunt feedback amplifiers-Frequency response, Input and output impedance.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Robert L. Boylestad and Louis Nashelsky ,"Electron Devices and Circuits: Theory and Practice", Prentice Hall of India, 10th Edition, 2009.
2. David A. Bell, "Electronic Devices and Circuits", Prentice Hall of India, 5th Edition, 2008.
3. Adel S.Sedra and Kenneth Smith ,"Microelectronic Circuits", Oxford University Press, Sixth edition,2009.

REFERENCES:

1. Millman and Halkias.C, "Integrated Electronics", Tata McGraw Hill, 2nd Edition, 2010.
2. Millman. J and Taub H, "Pulse Digital and Switching Waveforms'', Tata McGraw Hill, 3rd Edition, 2011.
3. S.Salivahanan, N.Suresh Kumar, A.Vallavaraj, Electronic Devices and Circuits, Tata McGraw Hill ltd., 2nd Edition, 2009.
4. Thomas.L.Floyd, "Electronic Devices: Conventional Current version", Pearson, 9th Edition, 2015.
5. B. Visvesvara Rao, K.Raja Rajeswari, P.Chalam Raju Pantulu and K.Bhaskara Rama, "Electronic Circuit Analysis", Pearson,1st Edition, 2012.

WEB REFERENCES:

1. https://nptel.ac.in/courses/108107142/
2. https://www.digimat.in/nptel/courses/video/108102095/L41.html
3. https://nptel.ac.in/courses/108102095/

ONLINE RESOURCES:

1. https://www.coursera.org/learn/transistor-field-effect-transistor-bipolar-junction-transistor
2. https://www.tutorialspoint.com/amplifiers/tuned_amplifiers.htm
3. https://www.udemy.com/course/introduction-to-semiconductor-diodes-and-transistors/
4. https://www.electronics-tutorials.ws/amplifier/amp_1.html

OUTCOMES:

Upon completion of the course, the student should be able to

1. Calculate the stability factors for the various types of biasing circuits.
2. Determine the input resistance, output resistance, voltage gain and current gain of single stage amplifier and multistage amplifier.
3. Derive the expression for voltage gain, input impedance, output impedance of types of feedback amplifiers and derive frequency of oscillation and condition of oscillation of RC and LC oscillators.
4. Deduce the equation of 3db bandwidth of single and double tuned amplifiers and analysis of multivibrators.

5. Derive the equation for power output and conversion efficiency of Power Amplifiers.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	-	2	-	-	-	-	-	-	-	-	2	1
CO3	3	2	-	2	-	-	-	-	-	-	-	-	2	1
CO4	3	-	-	2	2	-	-	-	-	-	-	-	2	1
CO5	3	2	2	2	2	-	-	-	-	-	-	-	2	1

SEMESTER - IV

20ECPW402 SDG NO. 4	LINEAR INTEGRATED CIRCUITS WITH LABORATORY	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To learn the basic building blocks and characteristics of Operational Amplifiers.
- To learn and design applications using Operational Amplifiers.
- To introduce the theory and applications of analog multipliers, PLL and Timer Ic's.
- To learn the theory of ADC and DAC.
- To Design waveform generators using operational amplifiers, voltage regulators and filters.

UNIT I BASICS AND APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Basic information about op-amps – Ideal Operational Amplifier - General operational amplifier stages -and internal circuit diagrams of IC 741, DC and AC performance characteristics, slew rate, Open and closed loop configurations. Operational Amplifiers – LF155 and Tl082.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator,

Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper.

UNIT III ANALOG MULTIPLIER, PLL AND TIMER ICS 9

Analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronisation. Timer IC 555 and Multivibrators using 555 IC.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS9

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R - 2R Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications - Flash type - Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion

UNIT V FILTERS WAVEFORM GENERATORS AND VOLTAGE REGULATORS 9

Sine-wave generators, Multivibrators, Triangular wave generator and Saw-tooth wave generator, ICL8038 function generator, IC Voltage regulators: Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switching regulator, Low Drop – Out(LDO) Regulators - Low-pass, high-pass and band-pass Butterworth filters, Switched capacitor filter IC MF10.

LIST OF EXPERIMENTS 15

Design and test the following circuits

1. Instrumentation amplifier and Schmitt Trigger using op-amp.
2. Active low-pass, High-pass and band-pass filters.
3. Phase shift and Wien bridge oscillators using Op-amp.
4. Astable and Monostable multivibrators using NE555 Timer.
5. DC power supply using LM317 and Lm723.
6. Simulate using PSPICE Full wave precision rectifier using Op-amp, Astable and Monostable using 741 Timer and A/D converter.
7. Design and simulate using PSPICE Voltage Controlled Oscillator, Analog Multiplier, and PLL as frequency multiplier.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. D.RoyChoudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2018, Fifth Edition. (Unit I – V).
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, Tata McGraw Hill, 2016 (Unit I –V).

REFERENCES:

1. Ramakant A.Gayakwad, "OPAMP and Linear ICs", 4thEdition, Prentice Hall / Pearson Education, 2015.
2. S.Salivahanan, V.S.KanchanaBhaskaran, ""Linear Integrated Circuits", TMH, 2nd Edition, 4th Reprint, 2016.
3. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", 6th Edition, PHI, 2001.
4. B.S.Sonde, "System Design using Integrated Circuits", 2ndEdition, New Age Pub, 2001.
5. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley International, 5th Edition, 2009.
6. William D.Stanley, "Operational Amplifiers with Linear Integrated Circuits", Pearson Education,4th Edition, 2001.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_ee13/preview
2. https://nptel.ac.in/courses/108108111/
3. http://web.iitd.ac.in/~shouri/eel782/lectures.php

ONLINE RESOURCES:

1. https://freevideolectures.com/course/2915/linear-integrated-circuits
2. https://e-box.co.in/linear-integrated-circuits.shtml

OUTCOMES:

Upon completion of the course, the student should be able to

1. Design linear and non-linear applications of OP AMPS.
2. Design applications using analog multiplier, PLL and Timer IC's.
3. Design ADC and DAC using OP AMPS.
4. Design filters, generate waveforms using op amps and study the characteristics of fixed and variable Voltage Regulators.
5. Design and implement applications using linear IC's like operational amplifiers, Timer IC555, and Voltage regulators. Simulate and analyze the characteristics and application of linear IC's using PSPICE.

CO - PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	2	-	-	-	-	2	2	3	2
CO2	3	1	3	2	-	2	-	-	-	-	2	2	3	2
CO3	3	1	3	2	-	2	-	-	-	-	2	2	3	2
CO4	3	1	3	2	-	2	-	-	-	-	2	2	3	2
CO5	3	1	3	2	3	2	-	-	2	3	2	2	3	2

SEMESTER - IV

20ECPC402 SDG NO. 4, 11	MICROPROCESSOR AND EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with supporting chips.
- To study the Architecture of 8051 microcontroller and ARM processor.
- To design a microcontroller based system.

UNIT I MICROPROCESSOR 9

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

UNIT II MICROCONTROLLER 9

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT III I/O INTERFACING 9

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming

and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

UNIT IV INTRODUCTION TO EMBEDDED SYSTEM DESIGN AND REAL TIME SYSTEMS **9**

Embedded system design process –Design example: Model train controller- Design methodologies- Design flows - Requirement Analysis – Specifications- System analysis and architecture design – Structure of a Real Time System –- Estimating program run times – Task assignment and scheduling.

UNIT V ARM PROCESSOR AND PERIPHERALS **9**

ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks and Subroutines – Features of the LPC 214X Family – Peripherals – The Timer Unit – Pulse Width Modulation Unit – UART – Block Diagram of ARM9 and ARM Cortex M3MCU.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design", 2nd Edition, Prentice Hall of India, 2007. (UNIT I & III).
2. Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2nd Edition, Pearson education, 2011. (UNIT II).
3. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", 3rd Edition, Morgan Kaufmann Publisher (An imprint from Elsevier), 2012. (UNIT IV, V).
4. Jane W.S.Liu, "Real Time Systems", Pearson Education, Third Indian Reprint, 2003.(UNIT IV).

REFERENCES:

1. DoughlasV.Hall, "Microprocessors and Interfacing, Programming andHardware",TMH, 2012.
2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals", 3rd Edition, Tata McGraw Hill, 2012.
3. Lyla B.Das, "Embedded Systems: An Integrated Approach", Pearson Education, 2013.
4. C.M.Krishna, Kang G.Shin, "Real-Time Systems", International Editions, McGraw Hill, 1997.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_ee42/preview
2. https://nptel.ac.in/courses/108105102/

ONLINE RESOURCES:

1. https://freevideolectures.com/course/3018/microprocessors-and-microcontrollers
2. http://www.satishkashyap.com/2012/02/video-lectures-on-microprocessors-and.html

OUTCOMES:

Upon completion of the course, the student should be able to

1. Describe and execute programs based on 8086microprocessor.
2. Design and implement 8051 microcontroller based systems.
3. Design Memory Interfacing circuits and I/O Circuits.
4. Model real-time applications using embedded-system concepts.
5. Describe the architecture and programming of ARM processor.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	3	3	1
CO2	2	2	3	1	2	-	-	-	-	-	-	2	3	2
CO3	3	3	3	1	2	2	-	1	3	-	3	2	3	2
CO4	3	3	2	2	1	2	-	1	-	-	2	2	3	2
CO5	2	3	3	1	1	2	-	1	-	-	2	2	3	2

SEMESTER - IV

20BSMA401 SDG NO. 4	PROBABILITY THEORY AND STOCHASTIC PROCESSES	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To provide the mathematical background of random variables, standard distributions and random processes for application to signal processing and Communication theory

UNIT I RANDOM VARIABLES AND STANDARD DISTRIBUTIONS 12

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal Distributions - Functions of Random variables.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

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

UNIT III INTRODUCTION TO STOCHASTIC PROCESS 12

Classification – Auto correlation functions – Cross correlation functions - Stationary process –Ergodic process-Power Spectral Density.

UNIT IV MODELS OF RANDOM PROCESSES 12

The Bernoulli process - The Gaussian process - Poisson process - Markov process - Markov chain.

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 12

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

TOTAL: 60 PERIODS

TEXTBOOKS:

1. Ibe O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007. Unit-I Chapter-2, Chapter-3 (Sections 3.1-3.5), Chapter-4 (Sections 4.1-4.8,4.10 & 4.11), Chapter 6 (Section 6.2) Unit-II Chapter 5 (Sections 5.1-5.7), Chapter 6 (6.8 & 6.10) Unit-III

Chapter-8 (8.1-8.7),10.5 Unit-IV Chapter 10 (Section 10.2,10.4, 10.5(10.5.1-10.5.6),10.6, 10.7) Unit-V Chapter 9 (Sections 9.1-9.3)

REFERENCES:

1. Peebles P.Z., "Probability, Random Variables and Random Signal Principles", Tata Mc Graw Hill, 4th Edition, New Delhi, 2002.
2. Veerarajan T., "Probability and Statistics, Random Processes and Queueing theory", Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi.
3. Athanasios Papoulis and S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes" PHI, 4th Edition, 2002.
4. Davenport, Probability and Random Processes for Scientist and Engineers, McGraw-Hill.
5. H. Stark &J.W. Woods: Probability, Random Processes and Estimations Theory for Engineers, (2/e), Prentice Hall.
6. E. Wong: Introduction to Random Processes, Springer Verlag.
7. W. A. Gardner: Introduction to Random Processes, (2/e), McGraw Hill.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc19_ma30/preview
2. https://nptel.ac.in/courses/111102111/
3. https://nptel.ac.in/courses/111/104/111104032/
4. http://www.ifp.illinois.edu/~hajek/Papers/probabilityJan13.pdf
5. https://www.ee.iitb.ac.in/~bsraj/courses/ee325/

ONLINE RESOURCES:

1. https://freevideolectures.com/course/2324/probability-and-random-processes.
2. http://www.nptelvideos.com/course.php?id=572.

OUTCOMES:

Upon completion of the course, the student should be able to

1 Solve problems on discrete and continuous random variables and standard (discrete and continuous) distributions.

2 Compute statistical constants related to two dimensional random variables, use transformation of random variables to find the probability density function and compute probabilities using central limit theorem.

3 Calculate autocorrelation, cross correlation and power spectral density of a random process and apply in analog and digital communication.

4 Analyze the various types of random processes.

5 Determine the temporal and spectral characteristics of the ouput corresponding to the input values of the linear systems.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	1	-	-	-	-	-	1	1
CO2	3	3	3	2	1	-	-	-	-	-	1	1
CO3	3	3	3	2	1	-	-	-	-	-	1	1
CO4	3	3	3	2	1	-	-	-	-	-	1	1
CO5	3	3	3	2	1	-	-	-	-	-	1	1

SEMESTER - IV

20BSCY201 SDG NO. 4,17	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the nature and facts about environment
- To find and implement scientific, technological, economic and political solutions to environmental problems
- To study the interrelationship between living organism and environment
- To provide the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 10

Definition, scope and importance of environment – need for public awareness – Ecosystem: concept of an ecosystem – structure and functions of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – food chains, food webs and ecological pyramids – ecological succession. Introduction to biodiversity definition: genetic, species and ecosystem diversity – values of biodiversity. Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – man-wildlife conflicts – endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ conservation

of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION **9**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies. Disaster management: floods, earthquake, cyclone and landslides – nuclear accidents and holocaust – case studies. Field study of local polluted site – Urban / Rural / Industrial /Agricultural.

UNIT III NATURAL RESOURCES **9**

Forest resources: Use and over – exploitation, deforestation, case studies – Water resources: Use and over- utilization of surface and ground water – dams-benefits and problems, conflicts over water – Mineral resources: Environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, case studies – Energy resources: Growing energy needs, use of alternate energy sources - renewable and non renewable energy sources – Land resources: land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **9**

From unsustainable to sustainable development – Sustainable Development Goals – Water conservation: rain water harvesting, watershed management – Climate change: global warming, chemical and photochemical reactions in the atmosphere – acid rain, ozone layer depletion – environmental ethics: Issues and possible solutions – 12 Principles of green chemistry – Environmental Legislation & Laws: Environment (Protection) Act – 1986 Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments - scheme of labelling of environmentally friendly products (Ecomark) – Issues involved in enforcement of environmental legislation - central and state pollution control boards, role of non-governmental organization – Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 8

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – Environmental Impact Assessment(EIA) - role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.
2. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004.

REFERENCES :

1. Dharmendra S. Sengar, "Environmental law", Prentice hall of India Pvt Ltd, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) Pvt Ltd., Hydrabad, 2015.
3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India Pvt. Ltd., Delhi, 2014.
4. Rajagopalan. R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.

OUTCOMES:

Upon successful completion of this course, student will be able to

1. Explain the basics of structure and functions of an ecosystem, the values of biodiversity and conservation of biodiversity.
2. Interpret the causes, effects and control measures of different pollution and disasters.
3. Remember the importance of natural resources and to know the role of an individual in conservation of natural resources and their case studies.
4. Create knowledge about the concept of Sustainable development, Environmental Laws and role of Government and Non - Governmental Organizations (NGO) in Environmental Protection.
5. Learn the importance of family welfare program, population explosion and Value education.

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	1	2	2	1	1	-	-	3
CO2	3	2	2	2	1	3	2	2	2	-	-	2
CO3	3	2	3	2	1	2	2	2	2	-	-	3
CO4	3	2	2	2	1	3	3	2	3	-	-	3
CO5	3	2	3	2	1	3	3	2	3	-	-	2

SEMESTER - IV

20ECPL401 SDG NO. 4, 11	MICROPROCESSOR AND EMBEDDED SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To Introduce ALP concepts, features and Coding methods
- Write ALP for arithmetic and logical operations in 8086 and 8051
- Interface different I/Os with Microprocessors
- Be familiar with MASM
- Write programs for ARM

LIST OF EXPERIMENTS:

8086 Programs using kits and MASM

1. Basic arithmetic and Logical operations.
2. Move a data block without overlap.
3. Code conversion, decimal arithmetic and Matrix operations.
4. Floating point operations, string manipulations, sorting and searching.

8051 Experiments using kits and MASM

1. Basic arithmetic and Logical operations.
2. Square and Cube program, Find 2's complement of a number.
3. Unpacked BCD to ASCII.

Peripherals and Interfacing Experiments

1. Traffic light controller.
2. Stepper motor control.
3. Digital clock.

ARM programs

1. Interfacing ADC and DAC.
2. Interfacing LED and PWM.
3. Interfacing LCD.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course, the student should be able to

1 Write ALP for fixed and Floating Point and Arithmetic operations.
2 Execute Programs in 8051.
3 Interface various peripherals in 8086/8051.
4 Execute Programs in ARM.
5 Formulate a mini project.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	3	2	2	-	-	-	2	2	1	2	2
CO2	3	1	2	3	1	2	-	-	-	2	2	3	2	2
CO3	3	2	2	2	1	2	-	-	-	2	2	2	3	2
CO4	3	2	2	3	3	2	-	-	-	2	2	1	3	2
CO5	2	2	2	3	1	2	-	-	-	2	3	2	2	3

SEMESTER - IV

20ECTE401 SDG NO. 4,11,15	LIVE-IN-LAB - II (VHDL SYNTHESIS)	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To provide opportunities for the students, expose to Industrial environment and real time work
- To enable hands-on experience in the electronics hardware/Software domain
- To enable development of skill set for designing and realizing prototype electronic systems/simulation model

COURSE METHODOLOGY

- This initiative is designed to inculcate ethical principles of research and to get involve in life-long learning process for the students.
- The project work must involve engineering design with realistic constraints. It must also include appropriate elements of the following: Engineering standards, design analysis, modeling, simulation, experimentation, prototyping, fabrication, correlation of data, and software development.
- Project can be individual work or a group project, with maximum of 3 students. In case of group project, the individual project report of each student should specify the individual's contribution to the group project.
- On completion of the project, the student shall submit a detailed project report. The project should be reviewed and the report shall be evaluated and the students shall appear for a viva-voce oral examination on the project approved by the Coordinator and the project guide.

EVALUATION

- First evaluation (Immediately after first internal examination) : 20 marks
- Second evaluation (Immediately after second internal examination): 30marks
- Final evaluation Last week of the semester) : 50marks

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to

1. Able to conduct literature survey to identify the gap and an application oriented research problem in the specific domain.
2. Able to design and validate the proposed system using simulation.
3. Able to prototype the proposed system.
4. Able to analyze the obtained results and prepare a technical report.
5. Able to publish the work in journals and apply for the patents.

CO- PO & PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO4	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - V

20ECPC501 SDG NO. 4,8,9	DIGITAL COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the principles of sampling and quantization
- To study the various waveform coding schemes
- To learn the various baseband transmission schemes
- To understand the various band pass signaling schemes
- To know the fundamentals of channel coding

UNIT I INFORMATION THEORY 9

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

UNIT II WAVEFORM CODING & REPRESENTATION 9

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

UNIT III BASEBAND TRANSMISSION & RECEPTION 9

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

UNIT IV DIGITAL MODULATION SCHEME 9

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

UNIT V ERROR CONTROL CODING 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S.Haykin, "Digital Communications", John Wiley, 2005. (Unit I –V).

REFERENCES:

1. B. Sklar, "Digital Communication Fundamentals and Applications", 2nd Edition, Pearson Education, 2009.
2. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press. 2007.
3. H P Hsu, "Schaum Outline Series — Analog and Digital Communications", TMH, 2006.
4. J.G Proakis, "Digital Communication", 4th Edition,Tata McGraw Hill Company, 2001.

WEB REFERENCES::

1. https://swayam.gov.in/nd1_noc20_ee17/preview
2. https://nptel.ac.in/courses/117/105/117105077/
3. http://www.ee.iitm.ac.in/~andrew/videolectures/EE419/index.html

ONLINE RESOURCES:

1. https://freevideolectures.com/course/4763/nptel-digital-communication/37
2. https://freevideolectures.com/course/2311/digital-communication/3
3. https://nptel.ac.in/courses/117/101/117101051/
4. https://www.youtube.com/watch?v=3ekWsXeZ8TM&list=PLgwJf8NK-2e5PngHbdEadEun5XPvnn00N&index=115

OUTCOMES:

Upon completion of the course, the student should be able to

1. Apply the principles of sampling & quantization.
2. Compare the various waveform coding schemes.
3. Learn and evaluate the various baseband transmission schemes.
4. Illustrate the various Band pass signaling schemes.
5. Analyze the fundamentals of channel coding.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	1	-	1	-	-	-	1	-	-	1	2	1
CO3	3	2	1	-	1	-	-	-	1	-	-	1	2	1
CO4	3	2	1	-	1	-	-	-	1	-	-	1	2	1
CO5	3	2	1	-	1	-	-	-	1	-	-	1	2	1

SEMESTER - V

20ECPW501 SDG NO. 4, 9	DISCRETE TIME SIGNAL PROCESSING WITH LABORATORY	L	T	P	C
		3	0	2	4

OBJECTIVES:

- To learn discrete Fourier transform, fast Fourier transform, properties of DFT and its application to linear filtering
- To understand the characteristics of digital filters, design digital IIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the characteristics of digital linear phase FIR filters, design digital FIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the effects of finite precision representations on digital filters and obtain knowledge and ability to use the digital Signal Processors to build DSP systems for real time problems
- Perform basic operations on signal processing and design filters using MATLAB, and to study the architecture of DSP Processor and Implement certain DSP algorithms on Digital Signal Processors

UNIT I DISCRETE FOURIER TRANSFORM 9

Summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF), Fast Fourier transform (FFT). Linear filtering using FFT.

UNIT II INFINITE IMPULSE RESPONSE FILTERS 9

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

UNIT III FINITE IMPULSE RESPONSE FILTERS 9

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

UNIT IV FINITE WORD LENGTH EFFECTS 9

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNIT V INTRODUCTION TO DIGITAL SIGNAL PROCESSORS 9

DSP functionalities - circular buffering – DSP architecture – Fixed and Floating point architecture principles – Programming – Application examples.

LAB COMPONENT – LIST OF EXPERIMENTS 15
MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of elementary Discrete-Time sequences, Linear and Circular convolutions, Auto correlation and Cross Correlation.
2. Frequency Analysis using DFT and FFT.
3. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation.

4. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations.

DSP PROCESSOR BASED IMPLEMENTATION

1. Study of architecture of Digital Signal Processor and Perform MAC operation using various addressing modes.
2. Generation of signals – Square, Triangular, Sawtooth.
3. Convolution.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. John G Proakis and Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson, 4th Edition, 2007
2. A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete Time Signal Processing", 8th Indian Reprint, Pearson, 2004.

REFERENCES:

1. Emmanuel C. Ifeachor & Barrie. W. Jervis, "Digital Signal Processing", 2nd Edition, Pearson Education / Prentice Hall, 2002.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata McGraw Hill, 2007.
3. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.
4. K. P. Soman and K. I. Ramachandran, "Insight into Wavelets - From Theory to Practice", Prentice Hall of India, Third Edition, 2010.
5. B. Venkataramani, M. Bhaskar, "Digital Signal Processors: Architecture, Programming and Application", Tata McGraw Hill Education, 2002.

WEB REFERENCES:

1. https://www.tutorialspoint.com/digital_signal_processing/index.htm
2. https://www.analog.com/en/design-center/landing-pages/001/beginners-guide-to-dsp. html
3. https://101science.com/dsp.htm

ONLINE RESOURCES:

1. https://swayam.gov.in/nd1_noc20_ee31https://nptel.ac.in/courses/117105134/
2. https://www.edx.org/course/discrete-time-signal-processing-4

OUTCOMES:

Upon completion of the course, the student should be able to

1. Apply DFT for the analysis of digital signals and systems.
2. Design IIR filter.
3. Design Linear phase FIR filters.
4. Characterize the effects of finite precision representation on digital filters and Implement certain DSP algorithms on Digital Signal Processors.
5. Execute basic signal processing operations and design filters using MATLAB and analyze the architecture and design DSP system for various applications of DSP Processor.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	3	-	-	-	1	-	-	2	3	-
CO2	3	3	2	2	2	-	-	-	1	-	-	3	3	2
CO3	3	1	2	1	2	-	-	-	1	-	-	3	3	1
CO4	3	2	2	3	2	2	-	-	1	-	-	3	3	2
CO5	3	3	2	2	2	2	-	-	-	-	3	2	3	2

SEMESTER - V

20ECPC502 SDG NO. 4, 9	VLSI DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the fundamentals of CMOS circuits and its characteristics
- To design and realize of combinational digital circuits
- To design and realize of sequential digital circuits
- To study the fundamentals of HDL
- Architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology are discussed

UNIT I INTRODUCTION TO MOS TRANSISTOR 9

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

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS 9

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls. Power: Dynamic Power, Static Power, Low Power Architecture.

UNIT III SEQUENTIAL CIRCUIT DESIGN 9

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

UNIT IV INTRODUCTION TO HDL 9

Introduction to HDLs, Basic Concepts of Verilog, Data Types, System Tasks and Compiler Directives, Gate Level Modeling: Gate Types and Gate Delays. Dataflow Modeling: Continuous assignment and delays. Design of Stimulus Block.

UNIT V DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM 9

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff. Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Neil H.E. Weste, David Money Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Pearson, 2017 (UNIT I,II).
2. Jan M. Rabaey, Anantha Chandrakasan, Borivoje. Nikolic, "Digital Integrated Circuits: A Design Perspective", 2nd Edition, Pearson, 2016 (UNIT III,V).
3. Samir Palnitkar, "Verilog HDL: A guide to Digital design and synthesis", 2nd Edition, Pearson Education, 2008 (UNIT IV).

REFERENCES:

1. Sung-Mo kang, Yusuf leblebici, Chulwoo Kim, "CMOS Digital Integrated Circuits: Analysis & Design", 4th Edition, McGraw Hill Education, 2013.
2. Wayne Wolf, "Modern VLSI Design: System On Chip", Pearson Education, 2007.
3. R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hall of India, 2005.

ONLINE RESOURCES:

1. https://freevideolectures.com/course/3507/digital-vlsi-system-design
2. https://www.tutorialspoint.com/vlsi_design/vlsi_design_useful_resources.html

COURSE OUTCOMES:

Upon completion of the course, the student should be able to

1. Realize the concepts of digital building blocks using MOS transistor.
2. Design combinational MOS circuits and power strategies.
3. Design and construct Sequential Circuits and Timing systems.
4. Demonstrate the concepts of HDL.
5. Design arithmetic building blocks and memory subsystems.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	2	2	3	2
CO2	3	2	2	2	1	-	-	-	-	-	2	2	3	2
CO3	3	2	2	2	1	-	-	-	-	-	2	2	3	2
CO4	3	3	2	1	3	-	-	-	-	-	2	2	3	3
CO5	3	3	3	3	3	-	-	-	-	-	2	2	3	3

SEMESTER - V

20ECPL501 SDG NO. 4, 9	COMMUNICATION SYSTEMS LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To visualize the effects of sampling and TDM
- To Implement AM & FM modulation and demodulation
- To implement PCM &DM
- To simulate Digital Modulation schemes
- To simulate Error control coding schemes

LIST OF EXPERIMENTS:

1. Signal Sampling and reconstruction.
2. Time Division Multiplexing.

3. AM Modulator and Demodulator.
4. FM Modulator and Demodulator.
5. Pulse Code Modulation and Demodulation.
6. Delta Modulation and Demodulation.
7. Line coding schemes.
8. Simulation of ASK, FSK, and BPSK generation schemes.
9. Simulation of DPSK, QPSK and QAM generation schemes.
10. Simulation of signal constellations of BPSK, QPSK and QAM.
11. Simulation of ASK, FSK and BPSK detection schemes.
12. Simulation of Linear Block and Cyclic error control coding schemes.
13. Simulation of Convolutional coding scheme.
14. Communication link simulation.
15. Radiation pattern of Yagi-uda Antenna.
16. Radiation pattern of Dipole Antenna.
17. Radiation pattern of Helical Antenna.
18. Radiation pattern of Loop Antenna.

TOTAL: 45 PERIODS

LAB REQUIREMENTS FOR A BATCH OF 30 STUDENTS / 3 STUDENTS PER EXPERIMENT:

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

JUSTIFICATION:

Radiation pattern measurement helps to design antennas for different types of environment.

OUTCOMES:

On completion of this laboratory course, the student should be able to

1. Simulate & validate the various functional modules of a communication system.
2. Demonstrate their knowledge in base band signaling schemes through implementation of digital modulation schemes.
3. Apply various channel coding schemes & demonstrate their capabilities towards the improvement of the noise performance of communication system.
4. Simulate end-to-end communication Link.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	3	1	-	-	-	-	-	2	3	3	2
CO2	3	3	1	3	1	-	-	-	-	-	2	3	3	2
CO3	3	3	1	3	1	-	-	-	-	-	2	3	3	2
CO4	3	3	1	3	1	-	-	-	-	-	2	3	3	2
CO5	3	3	1	3	1	-	-	-	-	-	2	3	3	2

SEMESTER - V

20ECPL502 SDG NO. 4, 9	VLSI LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To learn Hardware Descriptive Language(Verilog/VHDL)
- To learn the fundamental principles of VLSI circuit design in digital and analog domain
- To familiarize fusing of logical modules on FPGAs
- To provide hands on design experience with professional design (EDA) platforms

LIST OF EXPERIMENTS:

Part I: Digital System Design using HDL & FPGA **9**

1. Design an Adder (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
2. Design a Multiplier (4 Bit Min) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
3. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
4. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
5. Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
6. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.

Part-II: Digital Circuit Design

7. Design and simulate a CMOS inverter using digital flow.
8. Design and simulate a CMOS Basic Gates & Flip-Flops.
9. Design and simulate a 4-bit synchronous counter using a Flip-Flops.

Part-III Analog Circuit Design

10. Design and Simulate a CMOS Inverting Amplifier.
11. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers.
12. Design and simulate simple 5 transistor differential amplifier. Analyze Gain, Bandwidth and CMRR by performing Schematic Simulations

TOTAL: 45 PERIODS

LAB REQUIREMENTS :

Xilinx ISE/Altera Quartus/ equivalent EDA Tools	10 User License
Xilinx/Altera/equivalent FPGA Boards	10 nos
Cadence/Synopsis/ Mentor Graphics/Tanner/ equivalent EDA Tools	10 User License
Personal Computer	30 nos

COURSE OUTCOMES:

At the end of the course, the student should be able to

1. Write HDL code for basic as well as advanced digital integrated circuit.
2. Import the logic modules into FPGA Boards.
3. Synthesize the digital ICs and based on the synthesis done, Identification of critical paths and power consumption can be analyzed.
4. Create the place and route design of digital ICs.
5. Design, Simulate and Extract the layouts of Digital & Analog IC Blocks using EDA tools.

CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	2	3	1
CO2	3	1	2	3	3	-	-	-	-	-	-	2	3	-
CO3	3	3	3	3	3	-	-	-	-	-	-	2	3	1
CO4	3	3	3	3	3	-	-	-	-	-	-	2	3	1
CO5	3	2	3	3	3	-	-	-	-	-	-	2	3	1

SEMESTER - V

20ECTE501 SDG NO. 4,11,15	LIVE-IN-LAB - III (IOT)	L	T	P	C
		0	0	3	1

OBJECTIVES:

- To provide opportunities for the students, expose to Industrial environment and real time work
- To enable hands-on experience in the electronics hardware/Software domain
- To enable development of skill set for designing and realizing prototype electronic systems/simulation model

COURSE METHODOLOGY:

- This initiative is designed to inculcate ethical principles of research and to get involve in life-long learning process for the students.
- The project work must involve engineering design with realistic constraints. It must also include appropriate elements of the following: Engineering standards, design analysis, modeling, simulation, experimentation, prototyping, fabrication, correlation of data, and software development.
- Project can be individual work or a group project, with maximum of 3 students. In case of group project, the individual project report of each student should specify the individual's contribution to the group project.
- On completion of the project, the student shall submit a detailed project report. The project should be reviewed and the report shall be evaluated and the students shall appear for a viva-voce oral examination on the project approved by the Coordinator and the project guide.

EVALUATION

- First evaluation (Immediately after first internal examination) : 20 marks
- Second evaluation (Immediately after second internal examination): 30marks
- Final evaluation Last week of the semester) : 50marks

Note: All the three evaluations are mandatory for course completion and for awarding the final grade.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to

1. Able to conduct literature survey to identify the gap and an application oriented research problem in the specific domain

2. Able to design and validate the proposed system using simulation.
3. Able to prototype the proposed system.
4. Able to analyze the obtained results and prepare a technical report.
5. Able to publish the work in journals and apply for the patents.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO4	2	2	2	1	2	1	1	1	3	2	3	3	3	2
CO5	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - VI

20ECPC601 SDG NO. 1,4,9,11	TRANSMISSION LINES AND ANTENNAS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Determine the radiation fields of different wired antennas, array antennas and analyze its fundamental parameters
- Analyze the fields of different travelling wave antennas and compute the radiation fields of the Huygens source, aperture, slot and complementary dipole antennas
- To create awareness about the different types of propagation of radio waves at different frequencies

UNIT I TRANSMISSION LINES 9

Transmission line equations from source and load end. The finite and infinite lines. Velocity of propagation, input impedance. Open and short circuited lines, telephone cables, distortion less transmission, loading of cables, Campbell's formula. Properties of Transmission lines at UHF, Reflection co-efficient, Standing waves and SWR, Distribution of voltages and currents on loss less line. Characteristics of half wave, Quarter-wave and one eighth wave lines. Construction and applications of Smith chart. Transmission line matching. Single and double stub matching using Smith Chart.

UNIT II FUNDAMENTALS OF RADIATION 9

Concept of radiation - Types of antennas - Current distribution - Fundamental parameters: Radiation Pattern-Radiation Power Density - Radiation Intensity - Beamwidth - Gain - Directivity-Bandwidth Polarization - Antenna efficiency - Effective aperture -Friis transmission equation - Field regions separation - Monopole antenna - Half wave dipole: Field components - Total radiated power - Radiation resistance - Folded dipole

UNIT III ANTENNA ARRAYS 9

Need for antenna arrays - Design of two element array - Multiplication of pattern - N-element linear array : Uniform amplitude and spacing - Design of broadside & end fire arrays : Non-uniform amplitude and equal spacing - Design of binomial array - Phased array design - Yagi Uda antenna - Concept of smart antenna.

UNIT IV APERTURE AND SLOT ANTENNAS 9

Radiation from rectangular apertures, Uniform and Tapered aperture, Horn antenna, Reflector antenna, Aperture blockage, Feeding structures, Slot antennas, Microstrip antennas – Radiation mechanism – Application ,Numerical tool for antenna analysis.

UNIT V SPECIAL ANTENNAS AND WAVE PROPAGATION 9

Loop Antennas, Principle of frequency independent antennas –Spiral antenna, Helical antenna, Log periodic. Modern antennas- Reconfigurable antenna, Active antenna, Dielectric antennas, Electronic band gap structure.

and applications,

Wave Propagation : Modes of propagation - Structure of atmosphere - Ground wave propagation - Sky wave propagation - Virtual height - Maximum usable frequency - Skip distance - Space wave propagation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. C.A.Balanis, "Antenna Theory: Analysis and Design", John Wiley & Sons Inc., 4th Edition, 2015.
2. John D.Kraus, Ronald J.Marhefka, Ahmad S Khan, "Antennas and Wave Propagation" Tata McGraw Hill, 4th Edition 2010.

REFERENCES:

1. Warren L. Stutzman, Gary A. Thiele, "Antenna theory and design", John Wiley and Sons Ltd., 3rd Edition, 2013.
2. Edward C.Jordan and Keith G.Balmain" Electromagnetic Waves and Radiating Systems" Prentice Hall of India, 2006.

3. R.E.Collin,"Antennas and Radiowave Propagation", McGraw Hill 1985..
4. A.R.Harish, M.Sachidananda, "Antennas and Wave Propagation", Oxford University Press, 2007.
5. S.Drabowitch, A.Papiernik, J. Encinas, H,Griffiths and G.Smith, "Modern Antennas", Springer Science, 2013..
6. Handbooks/ Manuals of Simulation software packages like HFSS, CST and ADS..

WEB REFERENCES:

1. https://www.itu.int/dms_pub/itu-r/opb/hdb/R-HDB-59-2014-PDF-E.pdf

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/108101092/

OUTCOMES:

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

1. Explain the concept and derive radiation parameters for monopole & dipole.
2. Derive and Determine Array factor, Beam width & null angles of N-element linear arrays with uniform and non uniform amplitude and spacing.
3. Categorize antennas based on structure and radiation characteristics.
4. Analyze special antennas such as frequency independent and broad band.
5. Demonstrate an ability to test and measure parameters, interpret and analyze measured data, record and present results of tests on passive antennae.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	2	-	-	-	-	2	2	3	2
CO2	3	1	3	2	-	2	-	-	-	-	2	2	3	2
CO3	3	1	3	2	-	2	-	-	-	-	2	2	3	2
CO4	3	1	3	2	3	2	-	-	-	-	2	2	3	2
CO5	3	1	3	2	3	1	1	-	1	-	2	2	3	2

SEMESTER - VI

20ECPC602 SDG NO. 4,9	COMMUNICATION NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the division of network functionalities into layers
- Be familiar with the components required to build different types of networks
- Be exposed to the required functionality at each layer
- Learn the flow control and congestion control algorithms

UNIT I FUNDAMENTALS & LINK LAYER 9

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

UNIT II MEDIA ACCESS & INTERNETWORKING 9

Overview of Data link Control and Media access control - Ethernet (802.3) - Wireless LANs – Available Protocols – Bluetooth – Bluetooth Low Energy – WiFi – 6LowPAN–Zigbee - Network layer services – Packet Switching – IPV4 Address – Network layer protocols (IP, ICMP, Mobile IP).

UNIT III ROUTING 9

Routing - Unicast Routing – Algorithms – Protocols – Multicast Routing and its basics – Overview of Intradomain and interdomain protocols – Overview of IPv6 Addressing – Transition from IPv4 to IPv6.

UNIT IV TRANSPORT LAYER 9

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

UNIT V APPLICATION LAYER 9

Application Layer Paradigms – Client Server Programming – World Wide Web and HTTP - DNS- Electronic Mail (SMTP, POP3, IMAP, MIME) – Introduction to

Peer to Peer Networks – Need for Cryptography and Network Security – Firewalls.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Behrouz A. Forouzan, "Data communication and Networking", Fifth Edition, Tata McGraw Hill, 2013. (UNIT I–V)

REFERENCES:

1. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", 7th Edition, Pearson Education, 2016.
2. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2nd Edition, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw Hill Publisher, 2011.
4. Larry L. Peterson, BruceS. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufmann Publishers, 2011.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=HEEnLZV2wGI/
2. https://www.youtube.com/watch?v=vv4y_uOneC0

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106/105/106105080/
2. https://nptel.ac.in/courses/106/106/106106091/
3. https://www.coursera.org/specializations/computer-communications

OUTCOMES:

Upon completion of the course, the student should be able to

1. Identify and perceive the components required to build the types of computer networks.
2. Analyse the required functionality at each layer for given application.
3. Perceive the solution for each functionality at each layer.
4. Trace the flow of information from one node to another node in the network.
5. Apply the ideas learnt in developing a computer network.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	-	-	2	1	1
CO2	1	1	2	-	2	2	-	-	1	-	-	2	1	1
CO3	-	-	3	2	2	-	-	-	-	-	-	3	1	1
CO4	3	3	1	-	2	-	-	-	3	1	-	1	2	1
CO5	3	3	3	3	2	-	-	-	-	-	-	3	3	1

SEMESTER - VI

20ECPC603 SDG NO. 9, 12	WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the characteristic of wireless channel
- To understand the design of a cellular system
- To study the various digital signaling techniques and multipath mitigation techniques
- To understand the concepts of multiple antenna techniques

UNIT I WIRELESS CHANNELS 9

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

UNIT II CELLULAR ARCHITECTURE 9

Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations– Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity - trunking & grade of service – Coverage and capacity improvement.

UNIT III DIGITAL SIGNALING FOR FADING CHANNELS 9

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

UNIT IV MULTIPATH MITIGATION TECHNIQUES 9

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

UNIT V MULTIPLE ANTENNA TECHNIQUES 9

MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming - transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Rappaport,T.S., "Wireless Communications", Pearson Education, 2nd Edition, 2010.(UNIT I, II, IV)
2. Andreas F. Molisch, "Wireless Communications", John Wiley – India, 2006. (UNIT II,V)

REFERENCES:

1. Andrea Goldsmith , "Wireless Communication", Cambridge University Press, 2011.
2. Van Nee, R. and Ramji Prasad, "OFDM for Wireless Multimedia Communications", Artech House, 2000.
3. David Tse, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.
4. Upena Dalal, "Wireless Communication", Oxford University Press, 2009.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106/106/106106167/
2. https://nptel.ac.in/courses/117/104/117104115/
3. https://nptel.ac.in/courses/117/105/117105132/

ONLINE RESOURCES:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-452-principles-of-wireless-communications-spring-2006/

OUTCOMES:

At the end of the course, the student should be able to

1. Characterize a wireless channel and evolve the system design specifications.

2. Design a cellular system based on resource availability and traffic demands.
3. Identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration.
4. Compare multipath mitigation techniques and analyze their performance.
5. Design and implement MIMO system with transmit and receive diversity and analyze their performance.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	3	-	-	-	-	-	-	1	-	1	1
CO2	3	3	3	3	2	3	2	2	2	1	3	-	1	2
CO3	3	3	3	3	2	-	-	-	-	-	-	-	1	1
CO4	3	3	3	-	1	-	-	-	-	-	-	-	-	-
CO5	3	3	3	3	2	-	2	2	2	-	2	-	1	1

SEMESTER - VI

20HSPL501 SDG NO. 4, 8	COMMUNICATION AND SOFT SKILLS LABORATORY	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To develop effective communication and presentation skills
- To enhance the employability and career skills of the learners
- To enable the learners for preparing job application and e-portfolio
- To make the learners use soft skills efficiently
- To develop their confidence and help them in attending interviews successfully

UNIT I LISTENING AND SPEAKING SKILLS 6

Conversational skills participate in formal and informal talks – general, – group discussion – time management – group dynamics – GD strategies - making effective presentations - listening/watching interviews conversations, documentaries - listening to lectures, discussions from social media – improving articulation.

UNIT II ADVANCED READING AND WRITING SKILLS **6**

Reading different genres of texts - writing job applications – cover letter – résumé – emails – memos - writing abstracts – summaries – interpreting visual texts.

UNIT III SKILLS FOR COMPETITIVE EXAMS **6**

Reading passages for competitive exams – language focus exercise – building vocabulary tasks - FAQs related to competitive exams – current affairs - improving global reading skills – elaborating ideas – summarizing – understanding arguments – identifying opinion/attitude and making inferences - critical reading.

UNIT IV SOFT SKILLS **6**

Motivation – emotional intelligence – managing changes – stress management – leadership straits – team work – career planning – intercultural communication – creative and critical thinking

UNIT V INTERVIEW SKILLS **6**

Different types of interview – personal interview – panel interview – telephone/online interview - interview etiquette - answering questions – offering information – mock interviews – FAQs related to job interviews

TOTAL: 30 PERIODS

REFERENCES:

1. Business English Certificate Materials, Cambridge University Press.
2. Comfort, Jeremy, et al. Speaking Effectively: Developing Speaking Skills for Business English. Cambridge University Press, Cambridge, 2011.
3. International English Language Testing System Practice Tests, Cambridge University Press.
4. Personality Development (CD-ROM), Times Multimedia, Mumbai.

WEB REFERENCES:

1. http://www.slideshare.net/rohitjsh/presentation-on-group-discussion
2. http://www.oxforddictionaries.com/words/writing-job-applications
3. http://www.skillsyouneed.com/ips/interview-skills.html
4. http://www.personalitydevelopment.org/
5. https://nptel.ac.in/courses/109/107/109107121/
6. https://swayam.gov.in/nd1_noc19_hs33/preview
7. https://ict.iitk.ac.in/courses/enhancing-soft-skills-and-personality/

ONLINE RESOURCES:

1. https://www.britishcoucil.my/english/courses-adults/learning-tips/importance-of-soft-skills

2. https://www.skillsoft.com/content-solutions/business-skills-training/soft-skills-training/

OUTCOMES:

Upon completion of the course learners should be able to

1. Give oral presentations effectively.
2. Use technology to communicate effectively in various settings and context.
3. Develop skills required for workplace environment.
4. Communicate in forums like debate, group discussion and interviews confidently.
5. Develop skills required for workplace environment.

CO - PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	1	3	-	-
CO2	-	-	-	-	-	1	-	-	1	3	1	-
CO3	-	-	-	-	1	-	-	-	-	2	-	-
CO4	-	-	-	-	-	-	-	1	-	3	-	-
CO5	-	-	-	-	-	-	-	1	-	3	1	-

SEMESTER - VI

20ECPL601 SDG NO. 4, 9	ANTENNA LABORATORY	L	T	P	C
		0	0	2	1.5

OBJECTIVES:

- To understand the measurement of antenna parameters
- Design and implement antennas using EM tools

LIST OF EXPERIMENTS : 9

1. Study of structure and operation of wired, aperture, planar and array antennas.
2. Measurement of Radiation Pattern of Half wave dipole.
3. Measurement of radiation pattern of 5 element Yagi uda Antenna.
4. Measurement of Radiation Pattern of Planar Antennas.
5. Plot the radiation pattern of helical antenna.

6. Measurement of Radiation Pattern of broad side antenna array.
7. Measurement of Radiation Pattern of End fire antenna array.
8. Measurement of Radiation Pattern Reflector antennas.
9. Design and Simulation of Micro strip antenna using CST Tool.
10. Measurement of antenna parameters using network analyzer.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should be able to

1. Demonstrate the structure and operation of various antennas and describe their parameters.
2. Measure the radiation pattern of wired antennas.
3. Plot the radiation pattern of array of antennas.
4. Familiar with EM tools to implement antenna prototypes.
5. Analyse the antenna parameters using Network Analyzer.

CO - PO - PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	1	1	-	-	-	-	-	-	2	3	1
CO2	3	1	2	3	3	-	-	-	-	-	-	2	3	-
CO3	3	1	2	3	3	-	-	-	-	-	-	2	3	1
CO4	3	3	3	3	3	-	-	-	-	-	-	2	3	1
CO5	3	1	3	3	3	-	-	-	-	-	-	2	3	1

SEMESTER - VI

20ECPL602 SDG NO. 4, 9	NETWORK LABORATORY	L	T	P	C
		0	0	2	1.5

OBJECTIVES:

- Learn to communicate between two desktop computers.
- Learn to implement the different protocols.
- Be familiar with IP Configuration.
- Be familiar with the various routing algorithms.
- Be familiar with simulation tools.

LIST OF EXPERIMENTS :

1. Implementation of Error Detection / Error Correction Techniques
2. Implementation of Stop and Wait Protocol and sliding window
3. Implementation and study of Goback-N and selective repeat protocols
4. Implementation of High Level Data Link Control
5. Implementation of IP Commands such as ping, Traceroute, nslookup.
6. Implementation of IP address configuration.
7. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
8. Network Topology - Star, Bus, Ring .
9. Implementation of distance vector routing algorithm.
10. Implementation of Link state routing algorithm.
11. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS.
12. Implementation of Encryption and Decryption Algorithms using any programming language.

TOTAL: 45 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

SOFTWARE

- C / Python / Java / Equivalent Compiler.
- MATLAB SOFTWARE (Few experiments can be practiced with MATLAB)
- Standard LAN Trainer Kits - 4 Nos
- Network simulator like NS2/ NS3 / Glomosim / OPNET - 30 Equivalent

HARDWARE

- Standalone Desktops - 30 Nos

OUTCOMES:

Upon completion of the course, the student should be able to

1. Communicate between two desktop computers.
2. Implement different Protocols such as Stop & Wait, Go back N/Sliding window, Selective repeat, CSMA/CD & CSMA/CA.
3. Program using Sockets –Client server model, Echo/Ping/Talk commands/nslookup/ IP Configuration.
4. Implement and compare Distance vector and Link state routing, algorithms & congestion control algorithm.
5. Use simulation tool such as NS2/OPNET.

CO – PO, PSO MAPPING :

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

SEMESTER - VI

20ECPJ601 SDG NO. 4,11,15	INNOVATIVE DESIGN PROJECT	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To understand the engineering aspects of design with reference to simple products
- To foster innovation in design of products
- To develop design that add value to products and solve technical problems

COURSE PLAN

Study: Take minimum three simple products, processes or techniques in the area of specialization, study, analyze and present them. The analysis shall be focused on functionality, construction, quality, reliability, safety, maintenance, handling, sustainability, cost etc. whichever are applicable. Each student in the group has to present individually; choosing different products, processes or techniques.

Design: The project team shall identify an innovative product, process or technology and proceed with detailed design. At the end, the team has to document it properly and present and defend it. The design is expected to concentrate on functionality; design for strength is not expected.

Note: *The one hour/week allotted for tutorial shall be used for discussions and presentations. The project team (not exceeding four) can be students from different branches, if the design problem is multidisciplinary.*

TOTAL: 45 PERIODS

EVALUATION

1. First evaluation (Immediately after first internal examination) : 20 marks
2. Second evaluation (Immediately after second internal examination): 20 marks
3. Final evaluation (Last week of the semester) : 60 marks

Note: *All the three evaluations are mandatory for course completion and for awarding the final grade.*

OUTCOMES:

Upon completion of the course, the student should be able to

1. Think innovatively on the development of components, products, processes or technologies in the engineering field.
2. Analyze the problem requirements and arrive workable design solutions.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Co1	3	3	3	3	3	3	2	2	3	3	3	2	3	3
CO2	3	3	3	3	3	3	2	2	3	3	3	2	3	3

SEMESTER - VII

20ECPC701 SDG NO. 4,7,9,11	RF AND MICROWAVE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To enhance the student knowledge in various parameters of microwave networks
- To equip the students with sound technical knowledge in microwave tubes
- To understand the fundamental concepts about microwave semiconductor devices

UNIT I HIGH FREQUENCY NETWORK THEORY AND PASSIVE DEVICES **10**

Types of Interconnection of two port networks , Formulation of S Parameters, Properties of S-Parameters,Reciprocal and Lossless network, Transmission Matrix, RF Passive Components: Resistor, Inductor and Capacitor at high

frequency, Chip Resistor, Chipcapacitor and microstrip lines. Passive Devices: Waveguide corners- Bends - Twist -matched loads and movable shorts, Waveguide Tees, Circulator, Isolator, Directional Coupler and Hybrid Rings.

UNIT II MICROWAVE SIGNAL GENERATION 9

Review of Conventional Vacuum Triodes, Tetrodes and Pentodes, High Frequency effects in Vacuum Tubes, Two Cavity Klystron Amplifier - Transit time- velocity modulation - bunching - efficiency, Reflex Klystron, Slow wave structures, Helix Travelling wave tube amplifier, Magnetrons.

UNIT III MICROWAVE MEASUREMENTS 7

Measuring Instruments : Principle of operation and application of VSWR meter, Power meter, Spectrum analyzer, Network analyzer, Measurement of Impedance, Frequency, Power, VSWR, Q-factor, Dielectric constant, Scattering coefficients, Attenuation, S-parameters.

UNIT IV MICROWAVE SEMICONDUCTOR DEVICES 9

Tunnel Diode, Varactor diode, Crystal and Schottkey diode detector and mixers, Gunn diode oscillator, IMPATT diode oscillator and amplifier, RF Bipolar Junction Transistor, RF Field Effect Transistor: Construction, High Electron Mobility Transistor: Functionality, Frequency Response, Temperature Behaviour and Noise Performance.

UNIT V RADIO FREQUENCY CIRCUITS 10

Amplifier Design: Characteristics, Power Relations, Stability considerations, Constant Gain, Noise Figure and Constant VSWR circles.Filter Design : Insertion loss methods, filter transforms and filter implementation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David M.Pozar, "Microwave Engineering", Wiley, 4th Edition, 2012.
2. Reinhold Ludwig and Gene Bogdanov, "RF Circuit Design - Theory and Applications", Prentice Hall, 2nd Edition, 2009.

REFERENCES:

1. Annapurna Das and Sisir K.Das, "Microwave Engineering", McGraw Hill Education (India) ,3rd Edition, 2015.
2. Robert.E.Colin, "Foundations of Microwave Engineering", John Wiley and Sons, 2nd Edition, 2007.

3. R.S. Rao, "Microwave Engineering", Prentice Hall of India, 2nd Edition, 2015.
4. Liao Y S, “Microwave devices and circuits”, Prentice Hall of India, New Delhi,2008.

WEB REFERENCES:

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

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/117101119/
2. https://nptel.ac.in/courses/108101112/

OUTCOMES:

Upon completion of the course, the student should be able to

1. Ability to analyze and characterize the given system or network based on its S-parameters.
2. Analyze the working and performance of Microwave signal generators.
3. Knowledge on test & measurement methods for measuring power, frequency, losses,VSWR, Scattering and spectral parameters.
4. Analyze the working of high frequency semiconductor devices.
5. Ability to design RF amplifier to meet criteria based on stability, gain and noise figure requirements Also ability to design RF filters and Knowledge to implement using microstrip lines.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	1	-	-	-	-	2	2	3	2
CO2	3	2	0	2	-	2	-	-	-	-	2	2	3	2
CO3	1	1	2	3	-	1	-	-	-	-	2	2	3	2
CO4	1	1	3	1	-	-	-	-	-	-	2	2	3	2
CO5	3	3	3	2	-	-	-	-	-	-	2	2	3	2

SEMESTER - VII

20ECPC702 SDG NO. 9, 11	OPTICAL COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study about the various optical fiber modes, configuration and transmission characteristics of optical fibers
- To learn about the transmission characteristics associated with dispersion and polarization techniques
- To learn about the various optical sources, detectors and transmission techniques
- To explore various idea about optical fiber measurements and various coupling techniques
- To enrich the knowledge about optical communication systems and networks

UNIT I INTRODUCTION TO OPTICAL FIBERS 9

Introduction, need for optical communication, salient features of optical fibers, Ray theory of light guidance, Basic optical laws and definitions, Total internal reflection, Acceptance angle, Numerical aperture, Modes of a fiber, single and multimode fibers, Step-index and graded-index fibers, Fiber fabrication techniques. Electromagnetic nature of light, Boundary Conditions, Reflection and transmission of waves at a boundary, Modal analysis of optical fibers, Linearly polarized modes.

UNIT II SIGNAL DEGRADATION IN OPTICAL FIBER 9

Attenuation, Absorption, Scattering losses, Bending losses, Core and Cladding losses, Signal dispersion, Inter symbol interference and bandwidth, Intra model dispersion, Material dispersion, Waveguide dispersion, Polarization mode dispersion, Intermodal dispersion. Pulse broadening In GI fibers, Mode Coupling, Design optimization of single mode fiber, Characteristics of single mode fiber, RI Profile cutoff wave length, Dispersion calculations, Mode field diameter.

UNIT III OPTICAL SOURCES, DETECTORS AND POWER COUPLING 9

Sources: Intrinsic and extrinsic material, Direct and indirect band gaps, LED structures, Surface emitting LED, Edge emitting LED, Quantum efficiency and LED power, Light source materials, Modulation of LED, LASER diodes, Modes and threshold conditions, Rate equations, External quantum efficiency.

Power Launching and Coupling: Source to Fiber Power Launching, Lensing Schemes for coupling improvement, Fiber-to-Fiber Joints, LED Coupling to Single mode Fibers-Fiber Splicing, Optical Connectors.

UNIT IV OPTICAL RECEIVER, MEASUREMENTS AND COUPLING 9

Detectors: PIN photo detector, Avalanche photo diodes, Photo detector noise, Noise sources, SNR, Detector response time, Avalanche multiplication noise, Fundamental receiver operation, preamplifiers, error sources, Front end amplifiers, Digital receiver performance, Probability of error, Receiver sensitivity, Quantum limit.

Optical power measurement, Attenuation measurement (Cut back & Insertion loss Methods), Dispersion measurement, Fiber Numerical Aperture Measurements, Fiber cut- off Wave length Measurements, Fiber diameter measurements, OTDR Field Applications: OTDR Trace-Attenuation Measurements and Fiber fault location.

UNIT V OPTICAL COMMUNICATION SYSTEMS AND NETWORKS 9

Digital Transmission Systems, System design consideration, Point–to–Point links, Link power budget, Rise time budget, WDM Concepts and Components, Elements of optical networks, SONET/SDH, Optical Interfaces, SONET/SDH Rings and Networks, Broadcast and select WDM Networks, Wavelength Routed Networks, Optical ETHERNET, Solitons, All-Optical Networking, Evolution, Benefits, Challenges, and Future Vision.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gred Keiser, "Optical Fiber Communication", McGraw Hill Education (India) Private Limited, 5th Edition, Reprint 2013.
2. Gred Keiser, "Optical Fiber Communication", McGraw Hill Education (India) Private Limited, 5th Edition, Reprint 2013. (UNIT I, IV, V)

REFERENCES:

1. John M. Senior, "Optical Fiber Communication", Pearson Education, 2nd Edition, 2007.
2. Rajiv Ramaswami, "Optical Networks", 2nd Edition, Elsevier, 2004.
3. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.
4. Govind P. Agrawal, "Fiber Optic Communication Systems", 3rd Edition, John Wiley & sons, 2004.

WEB REFERENCES:

1. https://ieeexplore.ieee.org/abstract/document/6166843

ONLINE REFERENCES

1. https://onlinecourses.nptel.ac.in/noc18_ph06

OUTCOMES:

Upon completion of the course, the student should be able to

1. Realize basic elements in optical fibers, different modes and configurations.
2. Analyze the transmission characteristics associated with dispersion and polarization techniques.
3. Discuss optical sources, detectors, power launching and coupling with their use in optical communication system.
4. Construct fiber optic receiver systems, measurements and coupling techniques.
5. Design optical communication systems and its networks.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	1	1	-	-	-	-	2	2	1
CO2	3	3	2	2	3	-	-	-	-	-	-	2	2	1
CO3	3	3	3	1	2	-	1	-	-	-	-	-	2	1
CO4	3	3	3	1	2	1	-	-	1	1	-	-	2	1
CO5	2	1	-	-	-	-	2	1	-	-	-	-	2	1

SEMESTER - VII

20CSPC601 SDG NO. 4	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents and about the various applications of AI

UNIT I INTRODUCTION **9**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems – Search Strategies- Uninformed- Heuristics- Informed.

UNIT II PROBLEM SOLVING METHODS **9**

Local Search Algorithms and Optimization Problems - Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing – Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games.

UNIT III REPRESENTATION OF KNOWLEDGE **9**

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

UNIT IV LEARNING **9**

Forms of Learning- Supervised Learning - Learning Decision Tree - Evaluating and Choosing the Best Hypothesis - Regression and Classification with Linear Models- Artificial Neural Network - Support Vector Machine - Ensemble Learning.

UNIT V APPLICATIONS **9**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Robot – Hardware – Perception – Planning – Moving.

TOTAL: 45 PERIODS

TEXT BOOKS:

1 S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.

2 I. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCES:

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach (Computer Science)", Jones and Bartlett Publishers, Inc., First Edition, 2008.
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press, 2009.

3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.

WEB REFERENCES:

1. https://books.google.co.in/books?id=uSvYmki2yg0C&printsec=frontcover&dq=Supervised+Learning&hl=en&sa=X&ved=0ahUKEwigkNa1xN3oAhWawjgGHe8hAzoQ6AEIKDAA#v=onepage&q=Supervised%20Learning&f=false

OUTCOMES:

Upon completion of the course, the students should be able to

1. Use appropriate search algorithms for any AI problem.
2. Represent a problem using first order and predicate logic.
3. Provide the apt agent strategy to solve a given problem.
4. Suggest supervised algorithm for any given problem.
5. Design applications for NLP that use Artificial Intelligence.

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	2	1	1		1	-	-	1	3	3
CO2	2	3	2	3	2	1	1		1	-	-	1	3	3
CO3	2	3	2	3	2	1	1		1	-	-	1	3	2
CO4	2	3	2	3	3	1	1		2	-	-	1	2	2
CO5	2	3	2	3	3	1	1		2	-	-	1	2	3

SEMESTER - VII

20HSMG601 SDG NO. 4,8,9,10,12	PRINCIPLES OF ENGINEERING MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

At the end of the course, the student is expected to

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Management – Science or Art – Manager Vs Entrepreneur – types of managers – Engineers as Managers. Evolution of Management – Scientific, human relations, system and contingency approaches – Types of Business organization – Sole proprietorship, partnership, company-public and private sector enterprises – Organization culture and Environment – Current issues and future trends in Management; Industry 4.0 – Engineering management in modern business.

UNIT II PLANNING 9

Planning, Technology Planning - Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – MBO – process - Principles and functions of engineering management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design – Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT IV DIRECTING AND CONTROLLING 9

Foundations of individual and group behaviour – Motivation – theories and techniques–Leadership – Level 5 leadership - theories – Leadership as a determinant of Engineering management - Communication – process and barriers – effective communication – Communication and IT - System and process of controlling – budgetary and non-budgetary control techniques.

UNIT V INNOVATION AND TECHNOLOGY MANAGEMENT 9

Innovation management of Product and Services, Role of R & D in Entrepreneurship, Breakthrough Innovation, Disruptive Innovation – Modern approaches in Engineering management – Green management, Lean management, Managing diversity. IPR – Principles of Ethics for Engineering Managers.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Tripathy.P.C and Reddy.P.N, "Principles of Management", Tata McGraw Hill, 1999.

REFERENCES:

1. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert, "Management", Pearson Education, 6th Edition, 2004.
3. Stephen A. Robbins and David A. Decenzo and Mary Coulter, "Fundamentals of Management", Pearson Education, 7th Edition, 2011.
4. Robert Kreitner and Mamata Mohapatra, "Management", Biztantra, 2008.
5. Harold Koontz and Heinz Weihrich, "Essentials of Management", Tata McGraw Hill,1998.

WEB RESOURCES:

1. https://www.managementstudyguide.com/organization-management.htm
2. https://nptel.ac.in/courses/110/105/110105034/
3. https://courses.lumenlearning.com/boundless-management/chapter/principles-of-management/

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/110/105/110105033/

OUTCOMES:

Upon completion of the course, the students should be able to

1. Get a clear idea on the practical implications of the management concepts in engineering with emphasis on the need for innovation in every sphere.
2. Manage functions like planning on international aspect of management.
3. Understand basic knowledge about organizing, staffing on international aspect of management.
4. Understand the concepts and principles of management viz., Directing, and Controlling in the changing business scenario.
5. Get through knowledge on the Efficient and Effective management of Men, Money and Technology towards developing the industrial system.

CO – PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	2	2	3	3	1	1	1
CO2	-	-	-	-	-	2	2	3	3	1	1	1
CO3	-	-	-	-	-	2	2	3	3	1	1	1
CO4	-	-	-	-	-	2	2	3	3	1	1	1
CO5	-	-	-	-	-	2	2	3	3	1	1	1

SEMESTER - VII

20ECPL701 SDG NO. 4,11,15	ADVANCED COMMUNICATION LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

The student should be made to:

- Understand the working principle of optical sources, detector, fibers.
- Develop understanding of simple optical communication link.
- Understand the measurement of BER and Pulse broadening.
- Understand and capture an experimental approach to digital wireless communication.
- Understand actual communication waveforms that will be sent and received across wireless channel.

LIST OF OPTICAL EXPERIMENTS

1. Measurement of connector, bending and fiber attenuation losses.
2. Numerical Aperture and Mode Characteristics of Fibers.
3. DC Characteristics of LED and PIN Photo diode.
4. Fiber optic Analog and Digital Link Characterization - frequency response (analog), eye diagram and BER (digital).

LIST OF WIRELESS COMMUNICATION EXPERIMENTS

1. Wireless Channel Simulation including fading and Doppler effects.
2. Simulation of Channel Estimation, Synchronization & Equalization techniques.
3. Analysing Impact of Pulse Shaping and Matched Filtering using Software Defined Radios.
4. OFDM Signal Transmission and Reception using Software Defined Radios.

LIST OF MICROWAVE EXPERIMENTS

1. VSWR, Impedance Measurement and Impedance Matching.
2. Characterization of Directional Couplers, Isolators, Circulators.
3. Gunn Diode Characteristics.
4. Microwave IC – Filter Characteristics.
5. S parameters Characterization of RF/ Microwave components using Vector Network Analyzer (VNA).
6. Analysis of RF Signals using Spectrum Analyzer.

TOTAL: 45 PERIODS

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

S.NO	NAME OF THE EQUIPMENT	REQUIRED
1.	Trainer kit for carrying out LED and PIN diode characteristics, Digital multi meter and optical power meter	2 Nos
2.	Trainer kit for determining the mode characteristics and losses in optical fiber	2 Nos
3.	Trainer kit for analyzing Analog and Digital link performance, 2 Mbps PRBS Data source, 10 MHz signal generator and 20 MHz Digital storage Oscilloscope	2 Nos
4.	Kit for measuring Numerical aperture and Attenuation of fiber	2 Nos
5.	Advanced Optical fiber trainer kit for PC to PC communication, BER Measurement and Pulse broadening.	2 Nos
6.	MM/SM Glass and plastic fiber patch chords with ST/SC/E2000 connectors	2 sets
7.	LEDs with ST / SC / E2000 receptacles – 650 / 850 nm	2 sets
8.	PIN PDs with ST / SC / E2000 receptacles – 650 / 850 nm	2 sets
9.	Digital Communications Teaching Bundle (LabVIEW/MATLAB/Equivalent software tools)	10 Users
10.	Transmit/ Receive pair of NI USRP-2920 transceivers (50 MHz to 2.2 GHz)	2 Nos

OUTCOMES:

On completion of this laboratory course, the student should be able to

1. Analyze the performance of simple optical link by measurement of losses and analyzing the mode characteristics of fiber.
2. Analyze the Eye Pattern, Pulse broadening of optical fiber and the impact on BER.
3. Estimate the Wireless Channel Characteristics and analyze the performance of Wireless Communication System.
4. Understand the intricacies in Microwave System design.
5. Perform characteristics of active and passive microwave components.

CO - PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	1	1	1	3	3	3	2	1	3	3
CO2	3	3	3	3	2	3	2	3	3	2	1	1	3	3
CO3	3	3	3	3	3	2	3	2	3	2	2	1	3	3
CO4	3	3	2	3	2	2	2	2	3	2	2	1	3	3
CO5	3	3	3	3	3	2	3	2	3	2	2	1	3	3

SEMESTER - VII

20CSPL601 SDG NO. 4	ARTIFICIAL INTELLIGENCE LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

- To learn Prolog Program
- To Implement in Prolog and its working environment
- To Implement N-Queen problem and puzzle problem using Prolog
- To Analyze the problem using BFS and DFS algorithm

LIST OF EXPERIMENTS :

1. Study of Prolog.
2. Write simple fact for the statements using Prolog.

3. Write predicates - one converts centigrade temperature to Fahrenheit, other checks if a temperature is below freezing.
4. Write a program to solve 4-Queen problem.
5. Write a program to solve 8-Puzzle problem.
6. Write a program to solve any problem using Breadth First Search.
7. Write a program to solve any problem using Depth First Search.
8. Write a program to solve Travelling Salesman Problem.
9. Write a program to solve Water Jug problem.
10. Write a program to solve Missionaries and Cannibal problem.
11. Write a program to implement Library Management System.

TOTAL: 45 PERIODS

LAB REQUIREMENTS :

SOFTWARE : Prolog

OUTCOMES:

On completion of this laboratory course, the student should be able to

1. Use appropriate search algorithms for any AI problem.
2. Represent a problem using first order and predicate logic.
3. Provide the apt agent strategy to solve a given problem.
4. Suggest supervised algorithm for any given problem.
5. Design applications for NLP that use Artificial Intelligence.

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	2	1	1	-	1	-	-	1	3	3
CO2	2	3	2	3	2	1	1	-	1	-	-	1	3	3
CO3	2	3	2	3	2	1	1	-	1	-	-	1	3	2
CO4	2	3	2	3	3	1	1	-	2	-	-	1	2	2
CO5	2	3	2	3	3	1	1	-	2	-	-	1	2	3

SEMESTER - VII

20ECPJ701 SDG NO. 4, 6,7,8, 9,11,12,13, 17	PROJECT PHASE - I	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students face reviews and viva voce examination.

GUIDELINES TO BE FOLLOWED:

The students may be grouped into 3 to 4 and work under a project supervisor and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor (faculty member). The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department. The Project Work Phase-I will have the following Sequence:

I. Problem Identification

1. A statement of system / process specifications proposed to be developed (Block Diagram / Concept tree)
2. List of possible solutions including alternatives and constraints
3. Cost benefit analysis
4. Time Line of activities

II. A report highlighting the design finalization [based on functional requirements and standards (if any)]

III. A presentation including the following:

1. Implementation Phase (Hardware / Software / both)
2. Testing and Validation of the developed system
3. Learning in the Project

IV. Consolidated report preparation

TOTAL: 60 PERIODS

OUTCOMES:

Upon completion of the course, the students should be able to

1. Comprehend an industrial or real life problem and identify right/ real issue with solution.
2. Complete the necessary studies and review the literature, design a setup of equipment and complete the analysis.
3. Write a project report based on the findings.

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Co1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	2	1	2	1	1	1	3	2	3	3	3	2

SEMESTER - VIII

20ECPJ801 SDG NO. 4,6,7, 8, 9,11,12,13,17	PROJECT PHASE-II	L	T	P	C
		0	0	8	4

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students face reviews and viva voce examination

GUIDELINES TO BE FOLLOWED:

The students may be grouped into 3 to 4 and work under a project supervisor and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor (faculty member). The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department. The Project Work Phase-II will have the following Sequence:

I. Problem Identification

1. A statement of system / process specifications proposed to be developed (Block Diagram / Concept tree)
2. List of possible solutions including alternatives and constraints
3. Cost benefit analysis
4. Time Line of activities

II. A report highlighting the design finalization [based on functional requirements and standards (if any)]

III. A presentation including the following

1. Implementation Phase (Hardware / Software / both)
2. Testing and Validation of the developed system
3. Learning in the Project

IV. Consolidated report preparation

TOTAL: 120 PERIODS

OUTCOMES :

Upon completion of the course, the students should be able to

1. Comprehend an industrial or real life problem and identify right/ real issue with solution.
2. Complete the necessary studies and review the literature, design a setup of equipment and complete the analysis.
3. Write a project report based on the findings.

CO- PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Co1	3	3	2	2	2	2	2	2	3	2	2	3	3	3
CO2	3	3	3	2	3	3	2	2	3	3	3	3	3	3
CO3	2	2	2	1	2	1	1	1	3	2	3	3	3	2

PROFESSIONAL ELECTIVES - I

20ECEL501 SDG NO. 3, 4, 9	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To obtain knowledge on various Soft computing techniques
- To get insight of genetic algorithm
- To provide adequate knowledge about feed forward /feedback neural networks
- To apply the concept of fuzzy logic in various systems
- To provide adequate knowledge about the applications of Soft Computing

UNIT I INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS **9**

Evolution of Computing - Soft Computing Constituents – From Conventional AI to Computational Intelligence - Machine Learning Basics

UNIT II GENETIC ALGORITHMS **9**

Introduction to Genetic Algorithms (GA) – Basic concepts-Working Principle-Inheritance operators-Cross Over-Inversion & Deletion- Mutation Operator-Generation Cycle. Applications of GA in Machine Learning - Machine Learning Approach to Knowledge Acquisition.

UNIT III NEURAL NETWORKS **9**

Machine Learning Using Neural Network, Adaptive Networks – Feed forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks - Reinforcement Learning – Unsupervised Learning Neural Networks – Adaptive Resonance architectures – Advances in Neural networks, Applications.

UNIT IV FUZZY LOGIC **9**

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions- Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making, Applications.

UNIT V NEURO-FUZZY MODELING **9**

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modelling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case studies.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft Computing”, Prentice-Hall of India, 2003.
2. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”, Prentice Hall, 1995.
3. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Pearson Edition., 2003.

REFERENCES:

1. Klir.G, Yuan B B, “Fuzzy sets and Fuzzy Logic” Prentice Hall of India private limited, 1997.
2. Laurene Fausett, “Fundamentals of Neural Networks”, Prentice hall, 1992
3. S.Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2010.
4. Timothy J Ross, “Fuzzy logic with Engineering Applications”, John Wiley and Sons, 2009.
5. Zimmermann H.J, "Fuzzy Set Theory and Its Application", Springer International Edition, 2011.

WEB REFERENCES:

1. https://swayam.gov.in/nd1_noc20_cs17/preview
2. https://nptel.ac.in/courses/106105173/
3. https://www.slideshare.net/sajidqaxi/fuzzy-logic-and-neural-networks
4. https://nptel.ac.in/courses/127105006/
5. https://www.youtube.com/watch?v=7C19X6pJEuU

ONLINE RESOURCES:

1. https://youtu.be/IZWTduVCrf8
2. https://www.iitg.ac.in/rkbc/CE602/CE602/Genetic%20Algorithms.pdf
3. http://www.cs.cmu.edu/~02317/slides/lec_8.pdf

OUTCOMES:

Upon completion of the course, the student should be able to

1. Understand the principles behind Soft computing techniques.
2. Understand fuzzy logic and Genetic algorithm concepts.
3. Apply and analyze the clustering and Neuro fuzzy techniques.
4. Apply ANN models and Fuzzy logic principles for industrial and societal application.
5. Create hybrid soft computing techniques.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	3	1	3
CO2	3	2	1	-	-	-	-	-	-	-	-	2	1	3
CO3	2	2	3	-	-	-	-	-	-	-	-	-	3	3
CO4	3	3	-	-	-	-	-	-	-	-	-	-	1	3
CO5	2	2	1	-	-	-	-	-	-	-	-	-	1	3

PROFESSIONAL ELECTIVES - I

20ECEL502 SDG NO. 11, 15	TELEVISION AND BROADCASTING SERVICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To familiarize the students with Television transmitters and receivers and TV signal transmission both analogue and digital TV
- To make them understand different signal processing steps of monochrome and color television both analog and digital
- To study colour television transmitters and receivers - analog and digital

UNIT I INTRODUCTION 9

Image- Geometric form and aspect ratio, image continuity, interlaced scanning frame rate and refresh rate. Picture resolution .Video signal -addition of synchronizing signal., Composite video signal, TV CCIR standards analogue and digital. Camera tubes: image Orthicon, Plumbicon, Vidicon, silicon Diode Array Videocon - modern digital cameras. Comparison of camera tubes, Monochrome TV camera and digital cameras. TV Signal Transmission and Propagation: Picture Signal transmission, positive and negative modulation, VSB transmission, sound signal transmission, standard channel BW and color TV transmitters. TV signal propagation, interference, TV broadcast channels, TV transmission Antennas.

UNIT II MONOCHROME TV RECEIVER 9

RF tuner, IF subsystem, video amplifier, sound section, sync separation and processing, deflection circuits, scanning circuits, AGC, noise cancellation,

video and inter carrier sound signal detection, vision IF subsystem of Black and White receivers, Receiver sound system: FM detection, FM Sound detectors and typical applications.

UNIT III SYNC SEPARATION AND DETECTION 9

TV Receiver Tuners, Tuner operation, VHF and UHF tuners, digital tuning techniques, remote control of receiver functions. Sync Separation, AFC and Deflection Oscillators: Synchronous separation, k noise in sync pulses, separation of frame and line sync pulses. AFC, single ended AFC circuit, Deflection Oscillators, deflection drive ICs, Receiver Antennas, Picture Tubes.

UNIT IV COLOR TELEVISION 9

Colour signal generation, additive colour mixing, video signals for colours, colour difference signals, encoding, Perception of brightness and colours luminance signal, Encoding of colour difference signals, formation of chrominance signals, color cameras, Colour picture tubes. Color Signal Encoding and Decoding: NTSC colour system, PAL colour system, PAL encoder, PAL-D Decoder, chrome signal amplifiers, separation of U and V signals, colour burst separation, Burst phase discriminator, ACC amplifier, Reference oscillator, Indent and colour killer circuits, U& V demodulators. Digital Television-modulation standards-Digital video broadcasting-modulation and de-modulation techniques - terrestrial and satellite broadcasting-multiplexing of audio and video. Digital compression-variable band width for different video applications-Economics of satellite band width.

UNIT V COLOR RECEIVER 9

Introduction to colour receiver, Electronic tuners-use of microprocessors, IF subsystem, Y-signal channel, Chroma decoder, Separation of U & V Color, Phasors, synchronous demodulators, Sub carrier generation, raster circuits. Digital TV: Introduction to Digital TV, Digital Satellite TV, Direct to Home Satellite TV, Digital TV Transmitter, Digital TV Receiver, Digital Terrestrial TV, LCD TV, LED TV, CCD Image Sensors, HDTV, Plasma TV, Smart TV

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Television and Video Engineering, A.M.Dhake, 2nd Edition.
2. Modern Television Practice – Principles, Technology and Service, R.R.Gallatin, New Age International Publication, 2002.
3. Monochrome and Colour TV- R.R. Gulati, New Age International Publication, 2002.

REFERENCES:

1. S.P.Bali, **"**Colour Television Theory and Practice", TMH, 1994.
2. B.Grob and C.E.Herndon, "Basic Television and Video Systems", McGraw Hill.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=Tbm90XvNe8o
2. https://www.youtube.com/watch?v=ayGzgvOwef8
3. https://www.youtube.com/watch?v=ihfMAvaWCG4

ONLINE RESOURCES:

1. http://www-inst.eecs.berkeley.edu/~cs150/sp99/sp99/project/compvideo.htm
2. https://www.maximintegrated.com/en/design/technical-documents/tutorials/1/1184.html

OUTCOMES:

Upon completion of the course, the student should be able to

1 Elucidate the basics of television engineering.
2 Learn the details of monochrome receiver.
3 Describe the signal format for colour television.
4 Understand the operation of TV receiver.
5 Be introduced to recent advancements in Television engineering.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	-	-	-	-	-	-	-	-	2	3	1
CO2	3	1	1	-	-	-	-	-	-	-	-	2	3	1
CO3	3	1	1	-	-	-	-	-	-	-	-	2	3	1
CO4	3	1	1	-	-	-	-	-	-	-	-	2	3	1
CO5	3	1	1	-	-	-	-	-	-	-	-	2	3	1

PROFESSIONAL ELECTIVES - I

20ECEL503 SDG NO. 3, 4	MEDICAL ELECTRONICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be made:

- To gain knowledge about the various physiological parameters both electrical and non-electrical and the methods of recording and also the method of transmitting these parameters.
- To study about the various assist devices used in the hospitals.
- To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9

Sources of bio medical signals, Bio-potentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, lead systems and recording methods, typical waveforms and signal characteristics.

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT 9

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

UNIT III ASSIST DEVICES 9

Cardiac pacemakers, DC Defibrillator, Dialyser, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems, Heart lung machine.

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY 9

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

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION 9

Telemedicine, Insulin Pumps, Radio pill, Endomicroscopy, Brain machine interface, Lab on a chip, Laser in medicine, cryogenic application.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Leslie Cromwell, "Biomedical Instrumentation and Measurement", Prentice Hall of India, New Delhi, 2007. (UNIT I – V)

REFERENCES:

1. Khandpur, R.S., "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi, 2003.
2. John G.Webster, "Medical Instrumentation Application and Design", 3rd Edition, Wiley India Edition, 2007.
3. Joseph J.Carr and John M.Brown, "Introduction to Biomedical Equipment Technology", John Wiley and Sons, New York, 2004.

WEB REFERENCES:

1. https://books.google.co.in/books/about/Principles_of_Medical_Electronics_and_Bi.html?id=Uu1_6V7H5n8C
2. https://www.youtube.com/watch?v=JOMsijqtHps
3. https://www.youtube.com/watch?v=i2mZylgP1Fk
4. https://www.youtube.com/watch?v=R8obTqD9MBY

ONLINE RESOURCES:

1. https://academicearth.org/biomedical-engineering/ww.youtube
2. https://www.ecs.soton.ac.uk/undergraduate/biomedical-electronic-engineering
3. https://www.sciencedirect.com/topics/engineering/medical-electronics
4. https://study.com/articles/Biomedical_Instrumentation_Courses_and_Training_Programs.html

OUTCOMES:

Upon completion of the course, the student should be able to

1. Know the human body electro- physiological parameters and recording of bio-potentials.
2. Comprehend the non-electrical physiological parameters and their measurement – body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.
3. Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators, dialyzers and ventilators.

4 Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgical diathermies , and bio-telemetry principles and methods.

5 Know about recent trends in medical instrumentation.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	1	-	-	-	-	-	1	3	2
CO2	2	2	3	2	2	3	3	-	-	-	-	-	2	1
CO3	2	2	3	2	-	3	-	-	-	-	-	-	3	2
CO4	1	3	3	-	2	-	-	-	-	-	-	-	3	2
CO5	-	3	3	2	1	-	-	-	-	-	-	-	2	1

PROFESSIONAL ELECTIVES - I

20ECEL504 SDG NO. 4, 9	NANOTECHNOLOGY AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a broad view of the nascent field of nanoscience and nanotechnology to undergraduates
- To explore the basics of nanomaterial synthesis and characterization
- To learn the basic structures of properties and measurement of nanomaterials
- To explore the basics of nanostructures
- To introduce the applications of nanotechnology

UNIT I INTRODUCTION TO NANOTECHNOLOGY 9

Basic Structure of Nanoparticles- Kinetics in Nanostructured Materials- Zero dimensional, size and shape of nanoparticles; one-dimensional and two dimensional nanostructures - clusters of metals and semiconductors, bio nano-particles.

UNIT II FABRICATION AND CHARACTERIZATION OF NANOMATERIALS9

Types of Nanomaterials (Quantum dots, Nanoparticles, Nanocrystals, Dendrimers, Buckyballs, Nanotubes)- Gas, liquid, and solid –phase synthesis of nanomaterials; Lithography techniques (Photolithography, Dip-pen and

Electron beam lithography); Thin film deposition; Electrospinning. Bio-synthesis of nanomaterials.

UNIT III PROPERTIES AND MEASUREMENT OF NANOMATERIALS 9

Optical Properties: Absorption, Fluorescence, and Resonance; Methods for the measurement of nanomaterials; Microscopy measurements: SEM, TEM, AFM and STM. Confocal and TIRF imaging.

UNIT IV NANO STRUCTURES 9

Carbon Nanotubes, Fullerenes, Nanowires, Quantum Dots. Applications of nanostructures. Reinforcement in Ceramics, Drug delivery, Giant magnetoresistance, etc., Cells response to Nanostructures.

UNIT V APPLICATIONS OF NANOTECHNOLOGY 9

Nano electronics, Nano sensors, Nanotechnology in Diagnostics applications, Environmental and Agricultural Applications of nanotechnology, Nano technology for energy systems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Bharat Bhushan, "Springer Handbook of Nanotechnology", 2004. (Unit I – V)
2. Hari Singh Nalwa, "Encyclopedia of Nanotechnology", 2004. (Unit I – V)

REFERENCES:

1. D. Michael Ashby, Paulo Ferreira, Daniel L. Schodek, Butterworth-Heinemann, "Nanomaterials, Nanotechnologies and Design: an Introduction to Engineers and Architects", 2009.
2. Z.L. Wang, Y. Liu, Z. Zhang, "Handbook of Nanophase and Nanostructured Materials (in four volumes)", Kluwer Academic/Plenum Publishers, 2003.
3. Tseung-Yuen Tseng and Hari Singh Nalwa, "Handbook of Nanoceramics and their Based Nanodevices", (Vol. 2), American Scientific Publishers.

WEB REFERENCES:

1. https://nptel.ac.in/courses/113106093/
2. https://nptel.ac.in/content/syllabus_pdf/113106093.pdf
3. https://swayam.gov.in/nd1_noc19_mm21
4. https://freevideolectures.com/course/4097/nptel-nanotechnology-science-applications

ONLINE RESOURCES:

1. https://www.edx.org/micromasters/purdue-nano-science-technology
2. https://www.edx.org/course/fundamentals-of-nanoelectronics-part-b-quantum-tra
3. https://www.edx.org/course/nanotechnology-fundamentals-of-nanotransistors

OUTCOMES:

Upon completion of the course, the student should be able to

1. Describe the basic science behind the properties of materials.
2. Interpret the creation, characterization, and manipulation of nanoscale materials.
3. Comprehend the exciting applications of nanotechnology at the leading edge of scientific research.
4. Discuss the basic structure of nanomaterials and its types.
5. Apply their knowledge of nanotechnology to identify how they can be exploited for new applications.

CO - PO, PSO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	1	-	-	-	-	-	2	3	2
CO2	3	2	2	3	3	1	-	-	1	-	1	2	3	2
CO3	3	2	1	3	3	1	-	-	1	-	-	2	2	1
CO4	3	2	1	2	-	-	-	-	-	-	-	2	2	1
CO5	3	2	1	3	3	2	2	-	-	-	1	2	3	2

PROFESSIONAL ELECTIVES - I

20ECEL505 SDG NO. 4	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To become familiar with digital image fundamentals
- To get exposed to image enhancement techniques in Spatial and Frequency domain
- To learn concepts of degradation function and restoration techniques

- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods.

UNIT I DIGITAL IMAGE FUNDAMENTALS 9

Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

UNIT II IMAGE ENHANCEMENT 9

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement.

UNIT III IMAGE RESTORATION 9

Image Restoration - Degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering.

UNIT IV IMAGE SEGMENTATION 9

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing - erosion and dilation, Segmentation by morphological watersheds – Basic concepts – Dam construction – Watershed segmentation algorithm.

UNIT V IMAGE COMPRESSION AND RECOGNITION 9

Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG, Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, 3rd Edition , 2010, Fifth Edition. (Unit I – V)

2. Anil K. Jain, “Fundamentals of Digital Image Processing”, Pearson, 2002. (Unit I –V)

REFERENCES:

1. Kenneth R. Castleman, “Digital Image Processing”, Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, “Digital Image Processing using MATLAB”, Pearson Education, Inc., 2011.
3. D. E. Dudgeon and R. M. Mersereau, “Multidimensional Digital Signal Processing”, Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, “Digital Image Processing”, John Wiley, New York, 4th Edition,2007.
5. Milan Sonka, Vaclav Hlavac & Roger Boyle, "Image processing, Analysis and Machine Vision", Thomson Asia Prt. Ltd, 4th Edition, 2015.
6. Sid Ahmed M.A., "Image Processing - Theory, Algorithm and Architecture", McGraw Hill, 2009

WEB REFERENCES:

1. Introduction to sensors: http://www.shortcourses.com/sensors/
2. Digital Image Fundamentals: http://www.ph.tn.tudelft.nl/Courses/FIP/Frames/fip.html
3. DIAL-Digital Image Analysis Laboratory http://www.ece.arizona.edu/~dial/
4. JPEG image compression standard: www.jpeg.org

ONLINE RESOURCES:

1. https://www.tutorialspoint.com/dip/image_processing_introduction.htm
2. https://sisu.ut.ee/imageprocessing/book/1

OUTCOMES:

Upon completion of the course, the student should be able to

1 Discuss the digital image fundamentals.
2 Elaborate the image enhancement techniques.
3 Describe image restoration and image compression techniques.
4 Illustrate image segmentation techniques.
5 Utilize to represent image in the form of features.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	3	2	-	-	-	-	-	2	2	2	1
CO3	2	2	2	2	2	-	-	-	-	-	2	2	2	1
CO4	2	1	2	3	2	-	-	-	-	-	2	-	2	1
CO5	3	1	2	2	2	-	-	-	-	-	3	2	2	1

PROFESSIONAL ELECTIVES - I

20ECEL506 SDG NO. 4, 9	CONTROL SYSTEMS ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION 9

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory- Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system.

UNIT II TIME RESPONSE ANALYSIS 9

Transient response - steady state response - Measures of performance of the standard first order and second order system - effect on an additional zero and an additional pole-steady state error constant and system - type number-PID control-Analytical design for PD, PI, PID control systems.

UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS 9

Closed loop frequency response-Performance specification in frequency domain - Frequency response of standard second order system - Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots - Cascade lead compensation - Cascade lag compensation - Cascade lag-lead compensation.

UNIT IV CONCEPTS OF STABILITY ANALYSIS 9

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability -Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system- Digital control design using state feedback.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. M.Gopal, "Control System–Principles and Design", Tata McGraw Hill,4th Edition, 2012.

REFERENCES:

1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, Fifth Edition, 2007.
2. K.Ogata,_ "Modern Control Engineering", 5th Edition, PHI, 2012.
3. S.K.Bhattacharya, "Control System Engineering", 3rd Edition, Pearson, 2013.
4. Benjamin.C.Kuo, "Automatic Control Systems", Prentice Hall of India, 7th Edition, 1995.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=5s6cHd8Nyj8
2. https://www.youtube.com/watch?v=zXMklO-jxIo
3. https://www.youtube.com/watch?v=FXbKYT1G6Xs
4. https://www.youtube.com/watch?v=IsGSmp5DjA4

ONLINE RESOURCES:

1. https://www.youtube.com/watch?v=UR-a-9lbAiA
2. https://www.youtube.com/watch?v=MzLIgk-Dm7U

OUTCOMES:

Upon completion of the course, the student should be able to

1 Describe the Modeling of Electrical & Mechanical systems & representation of systems.

2 Test the time domain analysis of control systems required for stability analysis.

3 Test the frequency domain analysis & to design the compensation technique that can be used to stabilize control systems.

4 Examine the stability analysis of control systems.

5 Inspect and explore the CT & DT systems in state variable analysis and digital control systems.

CO - PO - PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	-	-	-	-	-	1	-	-
CO2	3	3	3	3	2	2	-	-	-	-	-	1	-	-
CO3	3	3	3	3	2	2	-	-	-	-	-	1	-	-
CO4	3	3	3	3	2	2	-	-	-	-	-	1	-	-
CO5	3	3	2	3	2	2	-	-	-	-	-	1	-	-

PROFESSIONAL ELECTIVES - I

20ECEL507 SDG NO. 3,4,11,15	INDUSTRIAL IoT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Introduce how IoT has become a game changer in the new economy where the customers are looking for integrated value
- Bring the IoT perspective in thinking and building solutions
- Introduce the tools and techniques that enable IoT solution and Security aspects

UNIT I INTRODUCTION **9**

Introduction to IOT, What is IIOT? IOT Vs. IIOT, History of IIOT, Components of IIOT -Sensors, Interface, Networks, People & Process, Hype cycle, IOT Market, Trends& future Real life examples, Key terms – IOT Platform, Interfaces, API, clouds, Data Management Analytics, Mining &Manipulation; Role of IIOT in Manufacturing Processes Use of IIOT in plant maintenance practices, Sustainability through Business excellence tools Challenges & Benefits in implementing IIOT.

UNIT II ARCHITECTURES **9**

Overview of IOT components ;Various Architectures of IOT and IIOT, Advantages & disadvantages, Industrial Internet - Reference Architecture; IIOT System components: Sensors, Gateways, Routers, Modem, Cloud brokers, servers and its integration, WSN,WSN network design for IOT.

UNIT III SENSOR AND INTERFACING **9**

Introduction to sensors, Transducers, Classification, Roles of sensors in IIOT , Various types of sensors , Design of sensors, sensor architecture, special requirements for IIOT sensors, Role of actuators, types of actuators. Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACNet , Current, M2M etc.

UNIT IV PROTOCOLS AND CLOUD **9**

Need of protocols; Types of Protocols, Wi-Fi, Wi-Fi direct, Zigbee, Z wave, Bacnet, BLE,Modbus, SPI , I2C, IIOT protocols –COAP, MQTT,6lowpan, lwm2m, AMPQ IIOT cloud platforms : Overview of cots cloud platforms, predix, thingworks, azure etc. Data analytics, cloud services, Business models: Saas, Paas, Iaas.

UNIT V PRIVACY, SECURITY AND GOVERNANCE **9**

Introduction to web security, Conventional web technology and relationship with IIOT, Vulnerabilities of IoT, Privacy, Security requirements, Threat analysis, Trust, IoT security tomography and layered attacker model, Identity establishment, Access control, Message integrity, Non-repudiation and availability, Security model for IoT, Network security techniques Management aspects of cyber security.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications 2. Bernd Scholz-Reiter, Florian
2. Michahelles, "Architecting the Internet of Things", ISBN 978-3- 642-19156-5 e-ISBN 978-3-642-19157-2, Springer

REFERENCES:

1. Hakima Chaouchi, " The Internet of Things Connecting Objects to the Web" ISBN : 978-1-84821-140-7, Willy Publications.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2 nd Edition, Willy Publications.

3. Inside the Internet of Things (IoT), Deloitte University Press
4. Internet of Things - From Research and Innovation to Market Deployment;By Ovidiu & Peter; River Publishers Series
5. Five thoughts from the Father of the Internet of Things; by By Phil Wainewright – Kevin Ashton
6. How Protocol Conversion Addresses IIoT Challenges: White Paper By RedLion.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106105195/
2. https://freevideolectures.com/course/4231/nptel-introduction-industry-industrial-internet-things

ONLINE RESOURCES:

1. https://www.coursera.org/lecture/digital-thread-implementation/the-industrial-internet-of-things-iiot-za9wH
2. https://swayam.gov.in/nd1_noc20_cs24/preview

OUTCOMES:

Upon completion of the course, the student should be able to

1 Describe IOT, IIOT.
2 Understand, design and develop the real life IoT applications using off the shelf hardware and software.
3 Understand various IoT Layers and their relative importance.
4 Study various IoT platforms and Security.
5 Realize the importance of Data Analytics in IoT.

CO – PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	2	-	2	-	-	-	-	2	2
CO2	3	1	3	2	-	2	-	-	-	-	2	2
CO3	3	1	3	2	-	2	-	-	-	-	2	2
CO4	3	1	3	2	3	2	-	-	-	-	2	2
CO5	3	1	3	2	3	2	-	-	2	3	2	2

PROFESSIONAL ELECTIVES - II

20ECEL601 SDG NO. 4, 8, 9	WIRELESS NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concept of Wireless networks, protocol stack and standards
- To understand and analyse the network layer solutions for Wireless networks
- To study about fundamentals of 3G Services, its protocols and applications
- To have in depth knowledge on internetworking of WLAN and WWAN
- To learn about evolution of 4G Networks, its architecture and applications

UNIT I WIRELESS LAN 9

Introduction-WLAN technologies: - IEEE802.11: System architecture, protocol architecture, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, WPAN – IEEE 802.15.4, Wireless USB, Zigbee, 6LoWPAN, Wireless HART.

UNIT II MOBILE NETWORK LAYER 9

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6-Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing: Destination Sequence distance vector, IoT: CoAP.

UNIT III 3G OVERVIEW 9

Overview of UMTS Terrestrial Radio access network - UMTS Core network Architecture: 3GPP Architecture, User equipment, CDMA2000 overview-Radio and Network components, Network structure, Radio Network, TD-CDMA, TD – SCDMA.

UNIT IV INTERNETWORKING BETWEEN WLANS AND WWANS 9

Internetworking objectives and requirements, Schemes to connect WLANS and 3G Networks, Session Mobility, Internetworking Architecture for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution System.

UNIT V 4G & BEYOND **9**

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, IMS Architecture, LTE, Advanced Broadband Wireless Access and Services, MVNO.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jochen Schiller, "Mobile Communications", 2nd Edition, Pearson Education, 2012.
2. Vijay Garg, "Wireless Communications and Networking", 1st Edition, Elsevier 2007.

REFERENCES:

1. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", 2nd Edition, Academic Press, 2008
2. Anurag Kumar, D.Manjunath, Joy kuri, "Wireless Networking", 1st Edition, Elsevier, 2011.
3. Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", 1st Edition, Pearson Education, 2013.

WEB REFERENCES:

1. https://youtu.be/Eu_mTZxPofl

ONLINE RESOURCES:

1. https://pervasive.aau.at/BR/teaching/sn/wh1_2.pdf
2. http://tools.ietf.org/html/draft-ietf-core-coap-18
3. http://3gpp.org/about-3gpp

OUTCOMES:

Upon completion of the course, the student should be able to

1. Understand the concept about Wireless networks, protocol stack and standards.
2. Understand and analyse the network layer solutions for Wireless networks.
3. Know about fundamentals of 3G Services, its protocols and applications.
4. Have in depth knowledge on internetworking of WLAN and WWAN.
5. Learn about evolution of 4G Networks, its architecture and applications.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	2	2	1	-	2	1	2	3	1
CO2	3	2	2	2	3	3	2	1	-	2	1	3	3	1
CO3	3	3	2	3	3	1	2	1	-	2	1	3	3	1
CO4	3	3	3	2	3	1	2	2	-	2	1	3	3	1
CO5	3	3	3	2	3	1	2	1	-	2	1	3	3	1

PROFESSIONAL ELECTIVES - II

20ECEL602 SDG NO. 7, 9, 14	DSP PROCESSOR ARCHITECTURE AND PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the Basics on Digital Signal Processors
- To design the Programmable DSP's Architecture, On-chip Peripherals and Instruction set
- To design and simulate Programming for signal processing applications
- To learn and design Advanced Programmable DSP Processors
- To design and Compare the features of different family Processors

UNIT I FUNDAMENTALS OF PROGRAMMABLE DSPs 9

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

UNIT II TMS320C5X PROCESSOR 9

Architecture of C5X Processor – Addressing modes – Assembly language Instructions - Pipeline structure, On-chip Peripherals – Block Diagram of DSP starter.

UNIT III TMS320C6X PROCESSOR 9

Architecture of the C6x Processor - Instruction Set – Addressing modes, Assembler directives, On-chip peripherals, DSP Development System: DSP Starter Kit - Code Composer Studio - Support Files – Introduction to AIC23

codec and other on-board peripherals, Real-Time Programming Examples for Signals and Noise generation, Frequency analysis, Filter design .

UNIT IV ADSP PROCESSORS **9**

Architecture of ADSP-21XX and ADSP-210XX series of DSP processors-Addressing modes and assembly language instructions – Application programs –Filter design, FFT calculation.

UNIT V ADVANCED PROCESSORS **9**

Study of TI's advanced processors - TMS320C674x and TMS320C55x DSPs, ADSP's Black fin and Sigma DSP Processors, NXP's DSP56Fxx Family of DSP Processors, Comparison of the features of TI, ADSP and NXP DSP family processors. **TOTAL: 45 PERIODS**

TEXT BOOKS:

1. B. Venkataramani and M. Bhaskar, "Digital Signal Processors – Architecture, Programming and Application" Tata McGraw – Hill Publishing Company Limited. New Delhi, 2003.

REFERENCES:

1. Avtar Singh and S. Srinivasan, Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx, Cengage Learning India Private Limited, Delhi 2012 .
2. RulphChassaing and Donald Reay, Digital Signal Processing and Applications with the C6713 and C6416 DSK, John Wiley & Sons, Inc., Publication, 2012 (Reprint).
3. User guides Texas Instruments, Analog Devices and NXP.

WEB REFERENCES:

1. https://www.ti.com
2. https://www.analog.com/media/en/technical-documentation

ONLINE RESOURCES:

1. https://www.academia.edu/38043202/Architecture_of_ TMS320C50_ DSP_Processor
2. http://www.ti.com/general/docs/gencontent.tsp?contentId=46898

OUTCOMES:

Upon completion of the course, the student should be able to

1 Design and analyze the concept of Digital signal Processor.

2 Demonstrate their ability to Program the DSP Processor for signal processing applications
3 Demonstrate the On-chip Peripherals and Instruction set
4 Discuss, compare and select the suitable advanced DSP Processor for real time Processing applications.
5 Design and analyze the Advanced Programmable DSP processor.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	1	1	-	-	-	1	-	2	2	1
CO2	3	3	2	2	3	-	-	-	-	2	-	2	2	1
CO3	3	3	2	1	3	-	-	-	-	2	-	2	2	2
CO4	3	3	1	2	3	-	-	-	-	2	-	2	2	1
CO5	3	3	2	1	3	-	-	-	-	1	-	2	2	1

PROFESSIONAL ELECTIVES - II

20ECEL603	ELECTROMAGNETIC INTERFERENCE	L	T	P	C
SDG NO. 4,7,11,15	AND COMPATIBILITY	3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of Electromagnetic Interference
- To understand the EMI coupling methods
- To know the importance of Electromagnetic Compatible Techniques
- To explain the existing standards for Electromagnetic Compatibility
- To design EMI controlled PCB's and Circuits

UNIT I EMI/EMC CONCEPTS 9

EMI-EMC definitions; Sources and Victims of EMI; Conducted and Radiated EMI Emission and Susceptibility; Case Histories; Radiation Hazards to humans.

UNIT II EMI COUPLING PRINCIPLES 9

Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling; Differential mode coupling; Near field cable to cable coupling; Field to cable coupling; Crosstalk-NEXT, FEXT; Power mains and Power supply coupling; Transient EMI, ESD.

UNIT III EMI CONTROL MECHANISMS **9**

Shielding; EMI Filters; Grounding; Bonding; Isolation transformer; Transient suppressors; EMI Suppression Cables.

UNIT IV EMC DESIGN FOR CIRCUITS AND PCB'S **9**

Noise from Relays and Switches; Nonlinearities in Circuits; Cross talk in transmission line and cross talk control; Component selection and mounting; PCB trace impedance; Routing; Power distribution decoupling; Zoning; Grounding; Via's; Terminations.

UNIT V EMI MEASUREMENTS AND STANDARDS **9**

Open area test site; TEM cell; EMI test shielded chamber and shielded ferrite lined anechoic chamber; Line impedance stabilization networks; EMI Rx and spectrum analyzer; Civilian standards - CISPR, FCC, IEC, EN; Military standards-MIL461E/462.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. V. P. Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, New York, 1996. (Unit I – V)
2. Henry W. Ott, "Noise Reduction Techniques in Electronic Systems", A Wiley Inter Science Publications, John Wiley and Sons, New York, 1988. (Unit – IV)

REFERENCES:

1. Clayton R. Paul, "Introduction to Electromagnetic Compatibility", John Wiley and Sons, Inc, 1992.
2. Bernhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Edition, Artech house, Norwood, 1986
3. Don R. J. White, "Consultant Incorporate, —Handbook of EMI/EMC", Vol I-V, 1988.
4. Tim Williams, "EMC for Product Designers-Meeting the European EMC Directive" 3rd Edition, Newnes, 2001.
5. Tim Williams & Keith Armstrong, "EMC for Systems and Installations", 1st edition, Newnes, 2000.
6. Mark I. Montrose, "Printed Circuit Board Design Techniques for EMC Compliance—A Handbook for Designers", 2nd Edition, Wiley-Interscience-IEEE, 2000.

WEB REFERENCES:

1. https://www.fda.gov/radiation-emitting-products/radiation-safety/electromagnetic-compatibility-emc
2. https://emcfastpass.com/emc-testing-beginners-guide/
3. https://www.nasa.gov/centers/johnson/pdf/639521main_EMI-EMC_User_Test_Planning_Guide.pdf

ONLINE RESOURCES:

1. https://www.iec.ch/emc/explained/
2. https://www.tuv.com/india/en/electromagnetic-compatibility-(emc).html

OUTCOMES:

Upon completion of the course, the student should be able to

1. Identify the various types and mechanisms of Electromagnetic Interference.
2. Learn various types of EMI Coupling mechanism.
3. Propose suitable EMC techniques for the Identified EMI.
4. Adopt various EMI control mechanism in PCB Design.
5. Describe the various EMC Standards and methods to measure them.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	2	1	-	-	-	1	3	2
CO2	3	3	3	3	3	2	2	1	-	-	-	1	3	2
CO3	3	3	3	3	2	2	2	1	-	-	2	1	3	2
CO4	3	3	3	3	3	2	2	1	-	-	2	1	3	2
CO5	3	2	3	3	3	2	2	1	-	-	2	1	3	2

PROFESSIONAL ELECTIVES - II

20ECEL604 SDG NO. 4, 9	FPGA AND ASIC DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the architecture of different types of FPGA
- To familiarize the different types of programming technologies and logic devices
- To study the design flow of different types of ASIC
- To analyze the synthesis, Simulation and testing of systems
- To understand the design issues of SOC

UNIT I FPGA **9**

Field Programmable gate arrays- Logic blocks, routing architecture, Design flow technology - mapping for FPGAs, Xilinx XC4000 - ALTERA's FLEX 8000/10000, ACTEL's ACT-1,2,3 and their speed performance Case studies: Altera MAX 5000 and 7000 - Altera MAX 9000 – Spartan II and Virtex II FPGAs - Apex and Cyclone FPGAs.

UNIT II OVERVIEW OF ASIC AND PLD **9**

Types of ASICs - Design flow – CAD tools used in ASIC Design – Programming Technologies:

Antifuse – static RAM – EPROM and EEPROM technology, Programmable Logic Devices: ROMs and EPROMs – PLA –PAL. Gate Arrays – CPLDs and FPGAs.

UNIT III ASIC PHYSICAL DESIGN **9**

System partition -partitioning - partitioning methods – interconnect delay models and measurement of delay - floor planning - placement – Routing : global routing - detailed routing - special routing - circuit extraction - DRC.

UNIT IV LOGIC SYNTHESIS, SIMULATION AND TESTING **9**

Design systems - Logic Synthesis - Half gate ASIC -Schematic entry - Low level design language - PLA tools -EDIF- CFI design representation. Verilog and logic synthesis -VHDL and logic synthesis - types of simulation -boundary scan test - fault simulation - automatic test pattern generation.

UNIT V SOC DESIGN **9**

Design Methodologies – Processes and Flows - Embedded software development for SOC – Techniques for SOC Testing – Configurable SOC –

Hardware / Software codesign Case studies: Digital camera, Bluetooth radio / modem, SDRAM and USB.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. John V.Oldfield, Richard C Dore, “Field Programmable Gate Arrays”, Wiley Publications1995.
2. M.J.S .Smith, "Application Specific Integrated Circuits”, Addison -Wesley Longman Inc.,1997
3. R. Rajsuman, “System-on-a-Chip Design and Test”, Santa Clara, CA: Artech House Publishers, 2000.

REFERENCES:

1. S. Trimberger, “Field Programmable Gate Array Technology”, Edr, Kluwer Academic Publications, 1994.
2. John V.Oldfield, Richard C Dore, “Field Programmable Gate Arrays”, Wiley Publications1995
3. P.K.Chan & S. Mourad, “Digital Design Using Field Programmable Gate Array”, Prentice Hall, 1994.
4. Parag.K.Lala, “Digital System Design using Programmable Logic Devices”, BSP, 2003.
5. S. Brown, R. Francis, J. Rose, Z. Vransic, “Field Programmable Gate Array”, Kluwer Pubin, 1992.
6. Wayne Wolf, “FPGA-Based System Design”, Prentice Hall PTR, 2004.

WEB REFERENCES:

1. https://nptel.ac.in/courses/117108040/
2. https://nptel.ac.in/courses/117106092/
3. https://freevideolectures.com/course/2327/vlsi-circuits/23
4. https://freevideolectures.com/course/2327/vlsi-circuits/51

ONLINE RESOURCES:

1. https://www.intel.com/content/dam/www/programmable/us/en/pdfs/literature/an/an311.pdf
2. https://www.intrinsix.com/soc-design-fpga-design
3. https://hardwarebee.com/fpga-vs-asic-difference/

OUTCOMES:

Upon completion of the course, the student should be able to

1. Describe the basic architecture types in FPGA.
2. Interpret different types of programming technologies and logic devices.
3. Analyze the synthesis, Simulation and testing of systems..
4. Apply different high performance algorithms in ASICs.
5. Discuss the design issues of SOC.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	1	-	-	-	-	-	2	3	2
CO2	3	2	2	3	3	1	2	-	1	-	1	2	2	2
CO3	3	2	1	3	3	1	-	-	1	-	-	2	2	2
CO4	3	2	1	2	1	2	-	-	-	-	-	2	2	1
CO5	3	2	1	3	3	2	2	-	-	-	1	2	3	2

PROFESSIONAL ELECTIVES - II

20ECEL605 SDG NO. 4	ELECTRONICS PACKAGING AND TESTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce and discuss various issues related to the system packaging
- To introduce about CAD used in designing wiring boards and testing

UNIT I OVERVIEW OF ELECTRONIC SYSTEMS PACKAGING 9

Functions of an Electronic Package, Packaging Hierarchy, IC packaging: MEMS packaging, consumer electronics packaging, medical electronics packaging, Trends, Challenges, Driving Forces on Packaging Technology, Materials for Microelectronic packaging, Packaging Material Properties, Ceramics, Polymers, and Metals in Packaging, Material for high density interconnect substrates.

UNIT II ELECTRICAL ISSUES IN PACKAGING 9

Electrical Issues of Systems Packaging, Signal Distribution, Power Distribution, Electromagnetic Interference, Transmission Lines, Clock

Distribution, Noise Sources, Digital and RF Issues. Design Process Electrical Design: Interconnect Capacitance, Resistance and Inductance fundamentals; Packaging roadmaps - Hybrid circuits - Resistive, Capacitive and Inductive parasitic.

UNIT III CHIP PACKAGES **9**

IC Assembly - Purpose, Requirements, Technologies, Wire bonding, Tape Automated Bonding, Flip Chip, Wafer Level Packaging, reliability, wafer level burn – in and test. Single chip packaging: functions, types, material processes, properties, characteristics, trends. Multi chip packaging: types, design, comparison, trends. System – in - package (SIP); Passives: discrete, integrated, and embedded

UNIT IV PCB, SURFACE MOUNT TECHNOLOGY AND THERMAL CONSIDERATIONS **9**

Printed Circuit Board: Anatomy, CAD tools for PCB design, Standard fabrication, Micro via Boards. Board Assembly: Surface Mount Technology, Through Hole Technology, Process Control and Design challenges. Thermal Management, Heat transfer fundamentals, Thermal conductivity and resistance, Conduction, convection and radiation – Cooling requirements.

UNIT V TESTING **9**

Reliability, Basic concepts, Environmental interactions. Thermal mismatch and fatigue – failures – thermo mechanically induced –electrically induced – chemically induced. Electrical Testing: System level electrical testing, Interconnection tests, Active Circuit Testing, Design for Testability.

TOTAL: 45 PERIODS

TEXT BOOK:

1. Tummala, Rao R., "Fundamentals of Microsystems Packaging", McGraw Hill, 2001.

REFERENCES:

1. Blackwell (Ed), "The Electronic Packaging Handbook", CRC Press, 2000.
2. Tummala, Rao R, "Microelectronics Packaging Handbook", McGraw Hill, 2008.
3. Bosshart, "Printed Circuit Boards Design and Technology", Tata McGraw Hill, 1988.
4. R.G. Kaduskar and V.B.Baru, "Electronic Product design", Wiley India, 2011.
5. R.S.Khandpur, "Printed Circuit Board", Tata McGraw Hill, 2005.
6. Michael L. Bushnell & Vishwani D. Agrawal, "Essentials of Electronic

Testing for Digital, Memory & Mixed signal VLSI Circuits", Kluwer Academic Publishers, 2000.
7. M. Abramovici, M. A. Breuer, and A.D. Friedman, "Digital System Testing and Testable Design", Computer Science Press, 1990.

WEB REFERENCES:

1. https://nptel.ac.in/courses/112105267/
2. https://nptel.ac.in/courses/108108031/
3. http://www.nptelvideos.in/2012/11/an-introduction-to-electronics-system.html

ONLINE RESOURCES:

1. https://www.classcentral.com/course/swayam-electronic-packaging-and-manufacturing- 13021
2. https://advancedengineering.umd.edu/electronic-packaging
3. https://www.ipcindia.org.in/fundamentals-of-electronics-systems-packaging-esp

OUTCOMES: At the end of the course, the student should be able to

1. Explain the various packaging types used along with the associated thermal, speed, signal and integrity power issues.
2. Analyze the concepts of Electrical Issues in Packaging.
3. Design packages which can withstand higher temperature, vibrations and shock.
4. Design PCBs which minimize the EMI and operate at higher frequency.
5. Analyze the concepts of Testing and testing methods.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3	3	-	-	-	-	-	-	-	-	1	2
CO2	1	2	3	3	-	-	-	-	-	-	-	-	1	2
CO3	1	2	3	3	-	-	-	-	-	-	-	-	1	2
CO4	1	2	3	3	-	-	-	-	-	-	-	-	1	2
CO5	1	2	3	3	-	-	-	-	-	-	-	-	1	2

PROFESSIONAL ELECTIVES - II

20ECEL606 SDG NO. 4 & 9	MEMS AND NEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts of micro and nano electromechanical devices
- To know the fabrication process of Microsystems
- To know the design concepts of micro sensors and micro actuators
- To introduce the concepts of quantum mechanics and nano systems
- To introduce the concepts of micro and nano electromechanical devices

UNIT I INTRODUCTION TO MEMS AND NEMS 9

Introduction to Design of MEMS and NEMS, Overview of Nano and Micro-electromechanical Systems, Applications of Micro and Nano-electromechanical systems, Materials for MEMS and NEMS: Silicon, silicon compounds, polymers, metals.

UNIT II MEMS FABRICATION TECHNOLOGIES 9

Photolithography, Ion Implantation, Diffusion, Oxidation, CVD, Sputtering Etching techniques, Micromachining: Bulk Micromachining, Surface Micromachining, LIGA.

UNIT III MICRO SENSORS 9

MEMS Sensors: Design of Acoustic wave sensors, Vibratory gyroscope, Capacitive Pressure sensors, Case study: Piezoelectric energy harvester.

UNIT IV MICRO ACTUATORS 9

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces, Case Study: RF Switch.

UNIT V NANO DEVICES 9

Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nanorods based NEMS device: Gas sensor.

TOTAL:45 PERIODS

TEXT BOOK:

Micromachined Transducers Sourcebook by G.Kovacs, McGraw-Hill Publishers.

REFERENCES:

1. Marc Madou, "Fundamentals of Microfabrication", CRC press 1997.
2. Stephen D. Senturia, "Micro system Design", Kluwer Academic Publishers, 2001
3. Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata Mcraw Hill, 2002.
4. Chang Liu, "Foundations of MEMS", Pearson Education India limited, 2006,
5. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures", CRC Press, 2002.

WEB REFERENCES:

1. Johnson, D., TiNi Alloy Company www.sma-mems.com
2 http://mems.engr.wisc.edu/moreinfo.html
3. http://mail.vdivde-it.de/ut/EMSTO
4. http://itri.loyola.edu/MEMS/TOC.htm

ONLINE RESOURCES:

1. http://scme-nm.org
2. Catalog: http://scme-nm.org/index.php?option=com_docman&task=cat_view&gid=97&Itemid=226
3. Educational Materials : http://scme-nm.org/index.php?option = com_docman&task=cat_view&gid=97&Itemid=53

OUTCOMES:

Upon completion of the course, the student should be able to

1 Interpret the basics of micro/nano electromechanical systems including their applications and advantages.

2 Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.

3 Analyze the key performance aspects of electromechanical transducers including sensors and actuators.

4 Comprehend the theoretical foundations of quantum mechanics and Nano systems.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	1	-	-	-	-	-	2	3	2
CO2	3	2	2	3	3	2	-	-	1	-	2	2	3	2
CO3	3	2	1	3	3	1	-	-	2	-	-	2	2	1
CO4	3	2	1	2	-	-	-	-	-	-	-	2	2	1
CO5	3	2	1	3	3	3	2	-	-	-	1	2	3	2

PROFESSIONAL ELECTIVES - II

20MGEL601 SDG NO. 4,8,9,12	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concepts and philosophies of Quality Management
- To know the impact and significance of TQM principles on organizations in recent times

UNIT 1 INTRODUCTION **8**

Need and Evolution of Quality, Quality-Definitions, statements and dimensions of product and service quality TQM-concepts, Elements and Framework, Benefits & Obstacles of TQM, TQM-Culture, Strategic Quality Management, Costs of Quality.

UNIT II CONTRIBUTIONS AND APPROACHES TO QUALITY MANAGEMENT **9**

Renowned quality gurus- Deming, Juran, Crosby and Ishikawa, Contributions of Taguchi – Loss Function, Signal to Noise Ratio and design of experiments, Kaizen -principles and practices - 5S tools, Poka Yoke-8Discipline Methodology, Just in time, Continuous process improvement - PDCA cycle and 5 why analysis.

UNIT III CUSTOMER FOCUS AND TEAMWORK **8**

Identifying Customer Needs, QFD - Process, Building HoQ, Customer Satisfaction Measurement Techniques. Employee Involvement Practices. Individual Participation - Suggestion Systems & Empowerment, Motivation ,Leadership, Partnerships - Cross-Functional Teams, Supplier/Customer Partnerships, Problem -Solving Teams - Quality Circles.

UNIT IV STATISTICAL TOOLS & TECHNIQUES 11

SQC - Tools For Data Collection And Analysis – Seven tools(old and new),Statistical Process Control (SPC) – Construction of Control Chart – Variables and Attributes. Process Capability – concepts and measurement. Six Sigma models ,Lean six sigma, BPR, TPM, FMEA and Benchmarking.

UNIT V QUALITY SYSTEMS AND STANDARDS 9

Need for ISO 9000- ISO 9001: 2015 quality system-guidelines and clausewise requirements, Quality audits-types and responsibilities, ISO 14001:2004 EMS, ISO / TS 16949:2002, ISO 27001:2005 ISMS, SEI – CMMIand Awards - Demings Prize, MBNQA and criteria.

TEXT BOOKS :

1. Besterfield, "Total Quality Management", 3rd Edition, Pearson India.
2 Shridhara K Bhat, "Total Quality Management", Himalaya Publishing House, 2010.

REFERENCES :

1. Bedi Kanishka, "Quality Management", Oxford University Press.
2. Kiran D.R., "Total Quality Management - Key Concepts and Case Studies", Butterworth - Heinemann, 2016.
3. Poornima M Charantimath, "Total Quality Management", Pearson India, 2017
4. Sharma DD, "Total Quality Management, Principles, Practice and Cases", Sultan Chand and Sons.
5. Douglas C. Montgomory, "Introduction to Statistical Quality Control", Wiley Student Edition, 4th Edition, Wiley India Pvt Limited, 2008.

MOOC REFERENCES :

1. https://www.coursera.org/lecture/supply-chain-management/total-quality-management-wLrvy
2. https://swayam.gov.in/nd1_noc20_mg34/preview
3. https://www.openlearning.com/courses/total-quality-management/
4. https://www.udemy.com/course/tqm-in-academics/

ONLINE RESOURCES :

1. https://www.unido.org/sites/default/files/2009-04/A_roadmap_to_quality_volume_1_0.pdf
2. https://www.investopedia.com/terms/t/total-quality-management-tqm.asp

3. https://www.researchgate.net/publication/237006071_Total_Quality_Management_in_Academic_Libraries_A_Study
4. https://www.isixsigma.com/methodology/total-quality-management-tqm/introduction-and-implementation-total-quality-management-tqm/
5. https://study.com/academy/lesson/five-principles-of-total-quality-management-tqm.html

OUTCOME :

Upon completion of the course, the student should be able to

1. To understand the concepts of quality management.
2. To demonstrate the approaches of quality management.
3. To explore customer needs and enhance customer satisfaction.
4. To explore the tools and techniques of Quality management.
5. To understand quality system management and implementation.

CO - PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	-	1	-	1	1	-	-	-	1
CO2	3	3	3	2	2	-	1	1	-	-	-	1
CO3	3	3	2	2	2	-	1	1	-	-	-	1
CO4	2	2	3	2	2	-	1	1	-	-	-	1
CO5	3	3	3	2	2	2	1	1	-	-	-	1

PROFESSIONAL ELECTIVES - III

20ECEL701 SDG NO. 4	COGNITIVE RADIO	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the evolving software defined radio and cognitive radio techniques and their essential functionalities
- To study the basic architecture and standard for cognitive radio
- To understand the physical, MAC and Network layer design of cognitive radio
- To expose the student to evolving applications and advanced features of cognitive radio

UNIT I INTRODUCTION TO SOFTWARE-DEFINED RADIO AND COGNITIVE RADIO 9

Evolution of Software Defined Radio and Cognitive radio: goals, benefits, definitions, architectures, relations with other radios, issues, enabling technologies, radio frequency spectrum and regulations.

UNIT II COGNITIVE RADIO ARCHITECTURE 9

Cognition cycle – orient, plan, decide and act phases, Organization, SDR as a platform for Cognitive Radio – Hardware and Software Architectures, Overview of IEEE 802.22 standard for broadband wireless access in TV bands.

UNIT III SPECTRUM SENSING AND DYNAMIC SPECTRUM ACCESS 9

Introduction – Primary user detection techniques – energy detection, feature detection, matched filtering, cooperative detection and other approaches, Fundamental Tradeoffs in spectrum sensing, Spectrum Sharing Models of Dynamic Spectrum Access - Unlicensed and Licensed Spectrum Sharing, Fundamental Limits of Cognitive Radio.

UNIT IV MAC AND NETWORK LAYER DESIGN FOR COGNITIVE RADIO 9

MAC for cognitive radios – Polling, ALOHA, slotted ALOHA, CSMA, CSMA / CA, Network layer design – routing in cognitive radios, flow control and error control techniques.

UNIT V ADVANCED TOPICS IN COGNITIVE RADIO 9

Overview of security issues in cognitive radios, auction based spectrum markets in cognitive radio networks, public safety and cognitive radio, cognitive radio for Internet of Things.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Alexander M. Wyglinski, Maziar Nekovee, Thomas Hou, "Cognitive Radio Communications and Networks", Academic Press,Elsevier,2010. (Unit I to IV)
2. Huseyin Arslan(Ed.), "Cognitive Radio, Software Defined Radio and Adaptive Wireless Systems", Springer, 2007. (Unit V)

REFERENCES:

1. Bruce Fette, "Cognitive Radio Technology", Newnes, 2006.
2. Kwang-Cheng Chen, Ramjee Prasad, "Cognitive Radio Networks", John Wiley and Sons, 2009.

3. Ezio Biglieri, Professor Andrea J.Goldsmith, Dr.Larry J.Greenstein, Narayan B.Mandayam, H. Vincent Poor, "Principles of Cognitive Radio", Cambridge University Press,2012.

WEB REFERENCES:

1. https://www.classcentral.com/course/swayam-basics-of-software-defined-radios-and-practical-applications-10088
2. https://nptel.ac.in/courses/108107107/
3. https://www.ofcom.org.uk/research-and-data/technology/general/emerging-tech/cognitive-radio

ONLINE RESOURCES:

1. https://link.springer.com/chapter/10.1007/978-981-10-4280-5_68
2. https://www.sciencedirect.com/topics/computer-science/cognitive-radio-network

OUTCOMES:

Upon completion of the course, the student should be able to

1. Illustrate the evolution of software Defined Radio.
2. Interpret the basics and architecture of Software Defined Radio.
3. Outline the basics of Cognitive networks.
4. Develop the building of Cognitive architecture on SDR architecture.
5. Make use of the concept of wireless networks to build next generation networks.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	3	3	2	1	3	1	1	2	1	3	3	-
CO2	3	2	3	3	1	1	3	1	1	2	1	3	2	-
CO3	2	2	2	3	1	1	2	1	1	2	1	2	3	3
CO4	3	2	3	3	2	1	3	1	1	2	1	2	-	3
CO5	3	1	3	3	1	1	3	1	1	2	1	2	-	3

PROFESSIONAL ELECTIVES - III

20ECEL702 SDG NO. 4,9,11,15	WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Learn Ad Hoc network and Sensor Network fundamentals
- To understand the Wireless Sensor Architecture
- Have an in-depth knowledge on sensor network and design issues
- To understand the infrastructure establishment of Sensor networks
- Have an exposure to mote programming platforms and tools

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS 9

Elements of Ad Hoc Wireless Networks- Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.

UNIT II ARCHITECTURES 9

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT III NETWORKING SENSORS 9

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols-Energy-Efficient Routing, Geographic Routing.

UNIT IV INFRASTRUCTURE ESTABLISHMENT 9

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS 9

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005.

2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks - An Information Processing Approach", Elsevier, 2007.

REFERENCES:

1. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks Technology, Protocols and Applications”, John Wiley, 2007.
2. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

WEB REFERENCES:

1. https://www.sciencedirect.com/topics/computer-science/wireless-sensor-networks
2. https://www.elprocus.com/architecture-of-wireless-sensor-network-and-applications/

ONLINE RESOURCES:

1. https://www.digimat.in/nptel/courses/video/106105160/L01.html
2. www.tfb.edu.mk › Kniga-w02PDF

OUTCOMES:

Upon completion of the course, the student should be able to

1. Know the basics of Ad Hoc networks and Wireless Sensor Networks.
2. Explain the architecture and networking scenarios of Sensor Networks.
3. To comprehend the functionalities of physical and data link layer with the knowledge of routing protocol.
4. Illustrate the infrastructure establishment and network management.
5. Be familiar with the OS used in Wireless Sensor Networks and build basic modules.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	0	3	0	1	0	0	0	0	3	3	2	2
CO2	3	3	3	1	2	1	0	0	0	0	3	3	2	2
CO3	3	3	2	1	3	1	0	0	0	0	3	3	2	2
CO4	3	3	2	1	3	1	0	0	0	0	3	3	2	2
CO5	3	3	2	1	1	3	1	0	0	0	3	3	2	2

PROFESSIONAL ELECTIVES - III

20ECEL703 SDG NO. 4	MIXED SIGNAL IC DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Study the mixed signal of submicron CMOS circuits
- To Understand the various integrated based filters and topologies
- To Learn the data converters architecture, modeling and signal to noise ratio
- To Study the integrated circuit of oscillators and PLLs

UNIT I SUBMICRON CMOS CIRCUIT DESIGN 9

Submicron CMOS: Overview and Models, CMOS process flow, Capacitors and Resistors. Digital circuit design: The MOSFET Switch, Delay Elements, An Adder. Analog Circuit Design: Biasing, Op-Amp Design, Circuit Noise.

UNIT II INTEGRATOR BASED CMOS FILTERS 9

Integrator Building Blocks- low pass filter, Active RC integrators, MOSFET-C Integrators, gm-C integrators, Discrete time integrators. Filtering Topologies: The Bilinear transfer function, The Biquadratic transfer function, Filters using Noise shaping.

UNIT III DATA CONVERTER ARCHITECTURES 9

DAC Architectures- Resistor string, R-2R ladder Networks, Current Steering, Charge Scaling DACs, Cyclic DAC, and Pipeline DAC. ADC Architectures- Flash, Two-step flash ADC, Pipeline ADC, Integrating ADC's, Successive Approximation ADC.

UNIT IV DATA CONVERTER MODELING AND SNR 9

Sampling and Aliasing: A modeling approach, Impulse sampling, The sample and Hold, Quantization noise. Data converter SNR: An overview, Clock Jitter, Improving SNR using Averaging, Decimating filter for ADCs, Interpolating filter for DACs, Band pass and High pass sinc filters - Using feedback to improve SNR.

UNIT V OSCILLATORS AND PLL 9

LC oscillators, Voltage Controlled Oscillators. Simple PLL, Charge pumps PLLs, Non ideal effects in PLLs, Delay Locked Loops.

TOTAL: 45 PERIODS

TEXT BOOK:

1. David A. Johns, Ken Martin, "Analog Integrated Circuit Design", Wiley Student Edition, 2013

REFERENCES:

1. R.Jacob Baker, "CMOS Mixed Signal Circuit Design", Wiley India, IEEE Press, Reprint, 2008.
2. R.Jacob Baker, "CMOS Circuit Design, Layout and Simulation", Wiley India, IEEE Press, 2nd Edition, Reprint, 2009.
3. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, 33rd Reprint, 2016.

WEB REFERENCES:

1. https://nptel.ac.in/courses/117106030/
2. https://www.youtube.com/playlist?list=PLLDC70psjvq5vtrb0EdII4xIKA15ec-Ij
3. https://www.ee.iitb.ac.in/web/academics/courses/EE719

ONLINE RESOURCES:

1. https://engineering.tamu.edu/electrical/academics/degrees/ graduate/mixed-signal-integrated-circuit-design-online-certificate.html
2. https://www.classcentral.com/course/swayam-analog-ic-design-10032
3. https://extension.berkeley.edu/public/category/courseCategoryCertificateProfile.do?method=load&certificateId=54012374

OUTCOMES:

At the end of the course, the student should be able to

1. Apply the concepts for mixed signal MOS circuit.
2. Analyze the characteristics of IC based CMOS filters.
3. Design various data converter architecture circuits.
4. Analyze the signal to noise ratio and modeling of mixed signals.
5. Design oscillators and phase lock loop circuit.

CO - PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3	3	-	-	-	-	-	-	-	-	1	2
CO2	1	2	3	3	-	-	-	-	-	-	-	-	1	2
CO3	1	2	3	3	-	-	-	-	-	-	-	-	1	2
CO4	1	2	3	3	-	-	-	-	-	-	-	-	1	2
CO5	1	2	3	3	-	-	-	-	-	-	-	-	1	2

PROFESSIONAL ELECTIVES - III

20ECEL704 SDG NO. 4,9	PATTERN RECOGNITION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the fundamentals of pattern classifier
- To know about various clustering concepts
- To originate the various structural pattern recognition and feature extraction
- To understand the basic concepts of learning and decision trees
- To explore recent advances in pattern recognition

UNIT I PATTERN CLASSIFIER 9

Overview of Pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Problems with Bayes approach – Pattern classification by distance functions –Minimum distance pattern classifier.

UNIT II CLUSTERING 9

Clustering for unsupervised learning and classification - Clustering concept – C-means algorithm – Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clusters.

UNIT III FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION 9

KL Transforms – Feature selection through functional approximation – Binary selection - Elements of formal grammars - Syntactic description - Stochastic grammars –Structural representation.

UNIT IV INTRODUCTION, CONCEPT LEARNING AND DECISION TREES9

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

UNIT V RECENT ADVANCES 9

Neural network structures for pattern recognition -Neural network based pattern associators – Unsupervised learning in neural pattern recognition - Self organizing networks -Fuzzy logic - Fuzzy pattern classifiers - Pattern classification using Genetic Algorithms.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (Indian Edition), 2013.
2. Tou and Gonzalez, Pattern Recognition Principles, Wesley Publication Company, London, 1974.

REFERENCES:

1. Duda R.O., and Hart.P.E., Pattern Classification and Scene Analysis, Wiley, New York,1973.
2. Morton Nadier and Eric Smith P., Pattern Recognition Engineering, John Wiley & Sons, New York, 1993.
3. Narasimha Murty M and Susheela Devi V, "Pattern Recognition – An Algorithmic Approach", Springer, Universities Press, 2011.
4. Robert J.Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, John Wiley &Sons Inc., New York, 2007.

WEB REFERENCES:

1. https://nptel.ac.in/courses/117108048/
2. https://cedar.buffalo.edu/~srihari/CSE555/
3. https://sites.cs.ucsb.edu/~yfwang/courses/cs290i_prann/lecture.html

ONLINE RESOURCES:

1. https://freevideolectures.com/course/3194/pattern-recognition
2. https://www.classcentral.com/course/swayam-pattern-recognition-and-application-14228

OUTCOMES:

Upon completion of the course, the student should be able to

1. Understand the principles of pattern recognition.
2. Understand the algorithm to classify the data and identify the patterns.
3. Utilize the given data set to extract and select features for Pattern recognition.
4. Describe the decision tree and concept learning.
5. Discuss on recent advances in pattern recognition.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	3	1	2	2	-	-	-	2	2	3	2
CO2	3	2	3	2	1	2	1	-	-	-	2	2	3	2
CO3	3	3	3	3	2	3	-	-	-	-	2	2	3	3
CO4	3	3	3	2	3	2	1	-	-	-	2	2	3	3
CO5	3	3	3	2	3	2	2	-	2	3	2	2	3	3

PROFESSIONAL ELECTIVES - III

20ECEL705 SDG NO. 4&9	RADAR AND NAVIGATIONAL AIDS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To apply Doppler principle to radars and hence detect moving targets
- To refresh principles of antennas and propagation as related to radars
- To understand principles of navigation

UNIT I INTRODUCTION TO RADAR EQUATION 9

Introduction- Basic Radar –The simple form of the Radar Equation- Radar Block Diagram- Radar Frequencies –Applications of Radar – The Origins of Radar - Detection of Signals in Noise- Receiver Noise and the Signal-to-Noise Ratio-Probability Density Functions- Probabilities of Detection and False Alarm- Integration of Radar Pulses- Radar Cross Section of Targets- Radar cross Section Fluctuations- Transmitter Power-Pulse Repetition Frequency-Antenna Parameters- System losses – Other Radar Equation Considerations.

UNIT II MTI AND PULSE DOPPLER RADAR 9

Introduction to Doppler and MTI Radar- Delay –Line Cancellers- Staggered

Pulse Repetition Frequencies –Doppler Filter Banks - Digital MTI Processing - Moving Target Detector - Limitations to MTI Performance - MTI from a Moving Platform (AMIT) – Pulse Doppler Radar – Other Doppler Radar Topics- Tracking with Radar –Monopulse Tracking –Conical Scan and Sequential Lobing – Limitations to Tracking Accuracy - Low-Angle Tracking - Tracking in Range - Other Tracking Radar Topics - Comparison of Trackers - Automatic Tracking with Surveillance Radars (ADT).

UNIT III DETECTION OF SIGNALS IN NOISE 9

Matched – Filter Receiver – Detection Criteria – Detectors – Automatic Detector - Integrators - Constant-False-Alarm Rate Receivers - The Radar operator - Signal Management - Propagation Radar Waves - Atmospheric Refraction -Standard propagation - Nonstandard Propagation - The Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas – Phase Shifters - Frequency-Scan Arrays.

Radar Transmitters and Receivers - Introduction –Linear Beam Power Tubes - Solid State RF Power Sources - Magnetron - Crossed Field Amplifiers - Other RF Power Sources – Other aspects of Radar Transmitter.- The Radar Receiver - Receiver noise Figure – Super heterodyne Receiver - Duplexers and Receiver Protectors- Radar Displays.

UNIT IV RADIO DIRECTION AND RANGES 9

Introduction - Four methods of Navigation .- The Loop Antenna - Loop Input Circuits - An Aural Null Direction Finder - The Goniometer - Errors in Direction Finding - Adcock Direction Finders - Direction Finding at Very High Frequencies - Automatic Direction Finders – The Commutated Aerial Direction Finder - Range and Accuracy of Direction Finders - The LF/MF Four course Radio Range - VHF Omni Directional Range(VOR) - VOR Receiving Equipment - Range and Accuracy of VOR – Recent Developments.

Hyperbolic Systems of Navigation (Loran and Decca) - Loran-A - Loran-A Equipment - Range and precision of Standard Loran - Loran-C - The Decca Navigation System - Decca Receivers - Range and Accuracy of Decca - The Omega System.

UNIT V SATELLITE NAVIGATION SYSTEM 9

Distance Measuring Equipment - Operation of DME - TACAN - TACAN Equipment - Instrument Landing System - Ground Controlled Approach System - Microwave Landing System(MLS) The Doppler Effect - Beam Configurations -Doppler Frequency Equations - Track Stabilization - Doppler Spectrum - Components of the Doppler Navigation System - Doppler range Equation - Accuracy of Doppler Navigation Systems. Inertial Navigation - Principles of Operation - Navigation Over the Earth – Components of an

Inertial Navigation System - Earth Coordinate Mechanization - Strapped-Down Systems - Accuracy of Inertial Navigation Systems-The Transit System - Navstar Global Positioning System (GPS).

TOTAL:45 PERIODS

TEXTBOOKS:

1. Merrill I. Skolnik ," Introduction to Radar Systems", 3rd Edition Tata Mc Graw-Hill 2003.
2. N.S.Nagaraja, “Elements of Electronic Navigation Systems”, 2nd Edition, TMH, 2000.

REFERENCES:

1. Peyton Z. Peebles:, "Radar Principles", John Wiley, 2004
2. J.C Toomay, " Principles of Radar", 2nd Edition –PHI, 2004

WEB REFERENCES:

1. www.fas.org
2. www.mit.edu
3. www.ansoft.com

ONLINE RESOURCES:

1. http://nptel.iitm.ac.in/courses.php?branch=Ece
2. http://www.readartutorial.eu/07/waves/wa04.en.html

OUTCOMES:

Upon completion of the course, the student should be able to

1. Understand the basic radar system.
2. Analyse MTI and Pulse Doppler radar system.
3. Explore the detection of signals in noise.
4. Describe various direction finders in navigation.
5. Gain knowledge about different satellite navigation systems.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	2	1	-	-	-	-	-	2	3	2
CO2	3	2	2	3	3	1	-	-	1	-	1	2	3	2
CO3	3	2	1	3	3	1	-	-	1	-	-	2	2	1
CO4	3	2	1	2	2	2	2	-	-	-	-	2	2	1
CO5	3	2	1	3	3	2	2	-	-	-	1	2	3	2

PROFESSIONAL ELECTIVES - III

20MGEL701 SDG NO. 9, 12	FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9

Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle – Product Development Planning and Management.

UNIT II REQUIREMENTS AND SYSTEM DESIGN 9

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

UNIT III DESIGN AND TESTING 9

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – Challenges in Integration of Engineering Disciplines - Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical, Electronics and Software

Subsystems - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – Prototyping - Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation.

UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT 9

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - Sustenance -Maintenance and Repair – Enhancements - Product EoL - Obsolescence Management – Configuration Management - EoL Disposal.

UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9

The Industry - Engineering Services Industry - Product Development in Industry versus Academia –The IPD Essentials - Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, 5th Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, 11th Edition, 2005.

REFERENCES:

1. Hiriyappa B, “Corporate Strategy – Managing the Business”, Author House, 2013.
2. Peter F Drucker, “People and Performance”, Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, “Enterprise Resource Planning – Concepts”, 2nd Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, 7th Edition, 2013.

WEB REFERENCES:

1. https://www.udemy.com/course/strategic-product-management-and-leadership/
2. https://www.udemy.com/course/building-insanely-great-products/
3. https://www.coursera.org/learn/customer-insights-orientation

ONLINE RESOURCES:

1. https://pursuite-production.s3-ap-southeast-1.amazonaws.com/media/cms_page_media/162/FSIPD+OBF+-+2012+F0_1.pdf
2. https://futureskillsnasscom.edcast.com/pathways/product-management-primer-pathway/cards/5603673#

OUTCOMES:

At the end of the course, the student should be able to

1 Define, formulate and analyze a problem.
2 Solve specific problems independently or as part of a team.
3 Gain knowledge of the Innovation & Product Development process in the Business context.
4 Work independently as well as in teams.
5 Manage a project from start to finish.

CO - PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	2	1	1	-	-	2	-	-
CO2	3	3	3	3	2	1	1	-	3	-	2	-
CO3	3	2	3	3	3	1	2	1	3	-	2	3
CO4	3	3	2	3	2	-	-	-	-	2	-	-
CO5	3	3	3	3	2	1	2	1	3	-	3	-

PROFESSIONAL ELECTIVES - III

20MGEL707 SDG NO. 4,8,9,12	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To get an introductory insight about the IPR in national and international context
- To understand the procedures for IPR, registration and its enforcement

UNIT I INTRODUCTION **9**

Intellectual property: Introduction, meaning, nature, significance and types of intellectual property, importance of intellectual property rights, Protection of human innovations by IPR such as Patents, Trademarks, Copyright, Industrial Designs, Geographical Indications and Trade Secrets.

UNIT II AGREEMENTS AND TREATIES **9**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, General agreement on trade and tariff (GATT), Ben convention, Rome convention, Role of WTO and WIPO.

UNIT III PATENTS **9**

Concept of Patent – Historical view of Patent system in India and International Scenario, patent searching process, ownership rights and transfer, compulsory licenses, Procedure for filing of patents, Grants of patent, Benchmarks for patentability of inventions, Recent key changes and development.

UNIT IV TRADEMARKS AND COPYRIGHTS **9**

Concept of Trademarks and copyrights – Rationale behind the protection-Purpose, function and acquisition, ownership issues, Procedure for Registration, Industrial design and integrated circuits, protection of geographical indications and plant varieties, Recent Trends in copyrights and Trademark., Trade secrets -liability for misappropriations of trade secrets.

UNIT V LEGAL ASPECTS AND NEW DEVELOPMENTS **9**

Infringements of patents– Criteria of Infringement – Modes of Infringement-remedies and modification Protection against unfair competition,

enforcement of intellectual property rights, Intellectual property audits, New developments of intellectual property, Impact of international instruments relating to the protection of intellectual properties Future of IPR in National and International levels.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S.V. Satarkar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002.
2. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India Pvt Ltd, 2012.
3. P.Narayanan, Intellectual property rights Eastern law house-2018 3rd Edition (revised and updated).
4. Deborah, E. Bouchoux, Intellectual property right, Cengage learning-2018 5th Edition.

REFERENCES

1. Sterling, J. L. A., "World copyright law", (2008) 3rd Edition, London, Sweet & Maxwell.
2. GP Reddy, "Intellectual property rights & other laws", Gogia law agency.
3. Barrett, Margreth, "Intellectual Property", 3rd Edition, New York Aspen publishers, 2009.
4. "Inventing the Future: An introduction to Patents for small and medium sized Enterprises"; WIPO publication.
5. Cornish, William Intellectual Property: Patents, Copyright, Trademarks and allied rights, (2010) 7th Edition, London Sweet & Maxwell.
6. Kankanala and Kalyan.C, "Indian Patent Law and Practice (2010)", India, Oxford University Press.

WEB RESOURCES:

1. https://www.wipo.int/edocs/lexdocs/laws/en/ws/ws020en.pdf
2. http://caaa.in/Image/34_Hb_on_IPR.pdf
3. http://www.ipindia.nic.in/patents.htm
4. http://www.ipindia.nic.in/trade-marks.htm
5. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/627956/IP-Rights-in-India.pdf

6. https://economictimes.indiatimes.com/small-biz/resources/startup-handbook/intellectual-property-rights- registration/articleshow/59126802.cms?from=mdr

ONLINE RESOURCES:

1. https://www.coursera.org/learn/introduction-intellectual-property
2. https://www.edx.org/course/intellectual-property-law-and-policy-part-1
3. https://www.classcentral.com/tag/intellectual-property
4. https://swayam.gov.in/nd1_noc19_mg58/preview

OUTCOMES:

Upon completion of the course, the students will be able to

1. Understand the concepts of Intellectual property rights.
2. Demonstrate the agreements and treaties of Intellectual property rights.
3. Explore needs and avenues for patents.
4. Explore the necessity of Trade marks and Copy rights.
5. Understand the legal context and developments of Intellectual property rights.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	-	1	1	1	1	1	-	-	1	2	1
CO2	3	1	3	1	2	-	1	1	-	-	-	1	2	1
CO3	1	1	2	2	2	-	1	1	-	-	-	1	1	1
CO4	2	1	1	2	2	-	1	1	-	-	-	1	1	2
CO5	1	1	1	2	2	2	1	1	-	-	-	1	2	2

PROFESSIONAL ELECTIVES - IV

20ECEL801 SDG NO. 7, 9, 14	UNDERWATER WIRELESS COMMUNICATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Basics, Challenges and Issues in underwater acoustic propagation
- Different communication channels related to sea
- Architecture and the modeling of WSN scenario for underwater communication
- Applications and designing of underwater wireless models

UNIT I INTRODUCTION 8

Overview – Peculiarities of underwater acoustic communication channels relative to radio communication channels – Explorations establishing an innovative digital underwater acoustic communication signal processing system – Communication sonar equation.

UNIT II ACOUSTIC PROPERTIES AND ELEMENTS 10

Acoustic waves in water – The wave equation in various coordinate systems – radiation of a spherical source – Reciprocity – Oceanographic and physical properties – Reflection and transmission in multi-layered media – Ray acoustics and ray tracing – Normal modes – Acoustic transducers and antennas – Hydro acoustics.

UNIT III UNDERWATER ACOUSTIC COMMUNICATION CHANNELS 9

Theoretical methods of underwater acoustic fields – Sound transmission loss in the sea – Multipath effects in underwater acoustic communication channels – Fluctuation of transmitted sound in underwater acoustic communication channels – Noise in the sea.

UNIT IV UNDERWATER WIRELESS SENSOR NETWORKS 10

Architecture – Propagation phenomena of underwater sensor network – Issues and challenges – Radio communication model for underwater WSN. Case Study: Optimal Node Placement in underwater WSN.

UNIT V DESIGN AND APPLICATIONS 8

ROV: Modeling, Design and Control – AUV: Design Essentials and Concepts – Modeling and control.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Lufen Xu and Tianzeng Xu, "Digital Underwater Acoustic Communications", Academic Press, 2016.
2. Jens M Hovem, "Marine acoustics: The physics of sound in underwater environments", Los Altos Hills: Peninsula publishing, 2012.

REFERENCES:

1. K. M. Awan, P. A. Shah, K. Iqbal, S. Gillani, W. Ahmad, and Y. Nam, "Underwater Wireless Sensor Networks: A Review of Recent Issues and Challenges", WCMC, 2019.
2. Emad Felemban, Faisal Karim Shaikh, Umair Mujtaba Qureshi, Adil A. Sheikh, and Saad Bin Qaisar, "Underwater Sensor Network Applications: A Comprehensive Survey", IJDSN, Vol.11, 2015.
3. Carlos Uribe and Walter Grote, "Radio communication model for underwater WSN", 2009, 3rd International Conference on New Technologies, Mobility and Security, Pages (147-151).
4. Muhamad Felamban, Basem Shihada, and Kamran Jamshaid, "Optimal Node Placement in Underwater Wireless Sensor Networks", 2013, 27th International Conference on Advanced Information Networking and Applications (AINA), (pp. 492-499).
5. L. G. García-Valdovinos, T. Salgado-Jiménez, M. Bandala-Sánchez, L. Nava-Balanzar, R. Hernández - Alvarado, and J. Cruz-Ledesma, "Modelling, Design and Robust Control of a Remotely Operated Underwater Vehicle", International Journal of Advanced Robotic Systems, Vol.11(1), 2014.
6. L. A. Gonzalez, "Design, Modelling and Control of an Autonomous Underwater Vehicle", Bachelor of Engineering Honours Thesis 2004, Mobile Robotics Lab – CIIPS, The University of Western Australia.

ONLINE RESOURCES:

1. Gomes, R. M., Martins, A., Sousa, A., Sousa, J. B., Fraga, S. L., & Pereira, F. L. (2005, June). A new ROV design: issues on low drag and mechanical symmetry. In Europe Oceans 2005(Vol. 2, pp. 957-962). IEEE.
2. Chin, C. S., Lin, W. P., & Lin, J. Y. (2018). Experimental validation of open-frame ROV model for virtual reality simulation and control. Journal of Marine Science and Technology, 23(2), 267-287.
3. Underwater Wireless Sensor Networks 2015, Dongkyun Kim, JuanC.Cano,WeiWang,Floriano De Rango, and Kun Hua Volume 2015, Article ID 623042, 2 pages.
4. Design and Detection of Multilinear Chirp Signals for Underwater Acoustic Sensor Networks,En Cheng, Shengli Chen, and Fei Yuan, Volume 2015, Article ID 371579, 13 pages.

5. Doppler Estimation Based on Frequency Average and Remodulation for Underwater Acoustic Communication, Chan-Ho Hwang, Ki-Man Kim, Seung-Yong Chun, and Sang-Kook Lee,Volume 2015, Article ID 746919, 8 pages.
6. High Throughput Receiver Structure for Underwater Communication, Chang-Uk Baek and Ji-Won Jung, Volume 2015, Article ID 481576, 6 pages.
7. Underwater Sensor Network Applications: A Comprehensive Survey, Emad Felemban, Faisal Karim Shaikh, Umair Mujtaba Qureshi, Adil A. Sheikh, and Saad Bin Qaisar, Volume2015,Article ID896832,14pages.
8. Proteus II: Design and Evaluation of an Integrated Power-Efficient Underwater Sensor Node,Wouter A. P. van Kleunen, Niels A. Moseley, Paul J. M. Havinga, and Nirvana Meratnia, Volume 2015, Article ID 791046, 10 pages.

OUTCOMES:

Upon completion of the course, the student should be able to

1. Understand the basic properties of acoustics and its application elements.
2. Analyze and characterize the environmental fluctuations in underwater communication.
3. Understand the relationship between different communication channels in relate to sea.
4. Bring out the solutions for the challenges in building underwater WSN.
5. Design and model the different underwater communication scenarios.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	2	3	3	2	1	1	2	2	2	1
CO2	3	2	1	2	2	2	3	2	-	3	2	3	3	3
CO3	3	-	-	2	1	2	2	1	2	3	2	2	1	2
CO4	2	3	3	3	2	3	3	1	2	3	2	2	3	3
CO5	3	-	3	1	3	1	2	2	3	1	3	3	3	3

PROFESSIONAL ELECTIVES - IV

20ECEL802 SDG NO. 4	MOBILE AD HOC NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamental concepts and design issues of Mobile Ad Hoc Networks.
- To learn the architectures and protocols of Ad Hoc Wireless Networks.
- To Study state of art research developments in Ad Hoc Wireless Networking.

UNIT I INTRODUCTION **9**

Introduction to Ad Hoc networks – definition, characteristic features, applications. Characteristics of Wireless channel, Ad Hoc Mobility Models:- Indoor and outdoor models.

UNIT II MEDIUM ACCESS PROTOCOLS **9**

MAC Protocols: design issues, goals and classification. Contention based protocols - with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

UNIT III NETWORK PROTOCOLS **9**

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Energy aware routing algorithm, Hierarchical Routing, QoS aware routing.

UNIT IV END-END DELIVERY AND SECURITY **9**

Transport layer: Issues in designing- Transport layer classification, Ad Hoc transport protocols. Security issues in Ad Hoc networks: issues and challenges, network security attacks, secure routing protocols.

UNIT V CROSS LAYER DESIGN AND INTEGRATION OF AD HOC FOR 4G **9**

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, Cross layer cautionary perspective. Integration of Ad Hoc with Mobile IP networks.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. C.Siva Ram Murthy and B.S.Manoj, Ad Hoc Wireless Networks Architectures and protocols, 2nd edition, Pearson Education. 2007
2. Charles E. Perkins, Ad Hoc Networking, Addison – Wesley, 2000.

REFERENCES:

1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobile Ad Hoc networking, Wiley-IEEE press, 2004.
2. Mohammad Ilyas, The Handbook of Ad Hoc Wireless Networks, CRC press, 2002.
3. T. Camp, J. Boleng, and V. Davies "A Survey of Mobility Models for Ad Hoc Network.
4. V. Kawadia and P. P. Kumar, "A Cautionary Perspective on Cross-Layer Design," IEEE Wireless commn., vol 12, no 1,2005.

WEB REFERENCES:

1. http://www.tfb.edu.mk/amarkoski/WSN/Kniga-w03.pdf
2. https://ict.iitk.ac.in/courses/wireless-ad-hoc-and-sensor-networks/
3. https://www.mdpi.com/journal/sensors

ONLINE RESOURCES:

1.https://nptel.ac.in/courses/106106167/

2.https://nptel.ac.in/courses/106105160/

OUTCOMES:

Upon completion of the course, the student should be able to

1 Analyze the wireless Ad Hoc networks and mobility model based networks and compute various parameters associated with it.

2 Categorize the MAC protocols and analyze the design issues by comparing the protocols.

3 Examine the Ad Hoc routing protocols and illustrate the network layer and congestion mechanism.

4 Discuss the design issues and compare the transport layer and secure routing protocols based on the analysis of characteristics.

5 Illustrate the Cross layer design techniques and its integration with mobile IP Networks.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	0	3	0	1	0	0	0	0	3	3	2	2
CO2	3	3	3	1	2	1	0	0	0	0	3	3	2	2
CO3	3	3	2	1	3	1	0	0	0	0	3	3	2	2
CO4	3	3	2	1	3	1	0	0	0	0	3	3	2	2
CO5	3	3	2	1	1	3	1	0	0	0	3	3	2	2

PROFESSIONAL ELECTIVES - IV

20ECEL803 SDG NO.3,4,11,15	SATELLITE COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the basics of satellite orbits
- Understand the satellite segment and earth segment
- Analyze the various methods of satellite access
- Understand the applications of satellites
- Understand the basics of satellite Networks

UNIT I SATELLITE ORBITS 9

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

UNIT II SPACE SEGMENT 9

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders-The Antenna Subsystem.

UNIT III SATELLITE LINK DESIGN 9

Basic link analysis, Interference analysis, Rain induced attenuation and interference, Ionospheric characteristics, Link Design with and without frequency reuse.

UNIT IV SATELLITE ACCESS AND CODING METHODS 9

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, DAMA Assignment Methods, compression – encryption, Coding Schemes.

UNIT V SATELLITE APPLICATIONS 9

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH).

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Dennis Roddy, "Satellite Communication", 4th Edition, McGraw Hill International, 2006.
2. Timothy, Pratt, Charles, W. Bostain, Jeremy E.Allnutt, "Satellite Communication", 2nd Edition, Wiley Publications, 2002.

REFERENCES:

1. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall / Pearson, 2007.
2. N. Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.
3. Bruce R. Elbert, "The Satellite Communication Applications", Hand Book, Artech House Bostan London, 1997.
4. Tri T. Ha, "Digital Satellite Communication", 2nd Edition, 1990.
5. Emanuel Fthenakis, "Manual of Satellite Communications", McGraw Hill Book Co., 1984.
6. Robert G. Winch, "Telecommunication Trans Mission Systems", McGraw Hill Book Co., 1983.
7. Brian Ackroyd, "World Satellite Communication and Earth Station Design", BSP Professional Books, 1990.

WEB REFERENCES:

1. https://www.tutorialspoint.com/satellite_communication/index.htm
2. https://www.isro.gov.in/applications/satellite-communication

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/117105131/

OUTCOMES:

Upon completion of the course, the student should be able to

1 Analyze the satellite orbits.
2 Analyze the earth segment and space segment.
3 Analyze the satellite Link design.
4 Analyze Satellite access and Coding methods
5 Design various satellite applications.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	-	2	-	-	-	-	1	2	3	2
CO2	3	1	1	1	-	2	-	-	-	-	1	2	3	2
CO3	3	3	3	3	3	2	1	-	-	-	2	2	3	2
CO4	3	1	1	1	-	2	-	-	-	-	1	2	3	2
CO5	3	1	1	1	3	2	1	-	-	-	1	2	3	2

PROFESSIONAL ELECTIVES - IV

20ECEL804 SDG NO. 4	CMOS ANALOG IC DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the fundamentals of analog circuits and MOS device models.
- To gain knowledge on various configurations of MOS transistors and feedback concepts.
- To study the characteristics of noise and frequency response of the amplifier.
- To learn the concepts of Op-Amp frequency compensation, capacitor switches and PLLs.

UNIT I INTRODUCTION TO ANALOG IC DESIGN AND CURRENT MIRRORS **9**

Concepts of Analog Design - General consideration of MOS devices – MOS I/V Characteristics – Second order effects – MOS device models. Basic current mirrors - Cascode current mirrors - Active current mirrors - Large and Small signal analysis- Common mode properties.

UNIT II AMPLIFIERS AND FEEDBACK 9

Basic Concepts – Common source stage- Source follower - Common gate stage- Cascode stage. Single ended and differential operation - Basic Differential pair- Common mode response- Differential pair with MOS loads - Gilbert Cell. Feedback- General Consideration of feedback circuits- Feedback topologies- Effect of loading - Effect of feedback on Noise.

UNIT III FREQUENCY RESPONSE OF AMPLIFIERS AND NOISE 9

General considerations- Miller Effect and Association of Poles with Nodes, Common source stage- Source followers- Common gate stage- Cascode stage- Differential pair. Noise- Statistical characteristics of noise- Types of noise- Representation of noise in circuits- Noise in single stage amplifiers- Noise in differential pairs- Noise Bandwidth.

UNIT IV OPERATIONAL AMPLIFIER STABILITY AND FREQUENCY COMPENSATION 9

General Considerations- One and Two Stage Op Amps- Gain Boosting- Comparison- Common mode feedback- Input range limitations- Slew rate- Power Supply Rejection- Noise in Op Amps- General consideration of stability and frequency compensation- Multipole system- Phase margin- Frequency compensation- Compensation of two stage op Amps- Other compensation techniques.

UNIT V SWITCHED CAPACITOR CIRCUITS AND PLLS 9

General Considerations- Sampling switches- Switched Capacitor Amplifiers- Switched Capacitor Integrator- Switched Capacitor Common mode feedback. Phase Locked Loops-Simple PLL- Charge pump PLLs - Non ideal Effects in PLLs- Delay locked loops- its Applications.

TOTAL:45 PERIODS

TEXT BOOK:

1. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill, 2001, 33rd re-print, 2016.

REFERENCES:

1. Phillip Allen and Douglas Holmberg, "CMOS Analog Circuit Design", Second Edition, Oxford University Press, 2004.
2. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, "Analysis and Design of Analog Integrated Circuits", 5th Edition, Wiley, 2009.
3. Grebene, "Bipolar and MOS Analog Integrated circuit design", John Wiley & sons, Inc., 2003.

4. Erik Brunn, "CMOS Analog IC Design Fundamentals", Bookboon.
5. R. J. Baker, "CMOS: Circuit Design, Layout, and Simulation", USA: Wiley, 2010.

WEB REFERENCES:

1. https://nptel.ac.in/content/storage2/courses/117101105/downloads/L1.pdf
2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/117106030/lec1.pdf
3. https://swayam.gov.in/nd1_noc20_ee26

ONLINE REFERENCES

1. https://aicdesign.org/
2. https://nptel.ac.in/courses/117101105/
3. https://ocw.tudelft.nl/courses/analog-integrated-circuit-design/

OUTCOMES:

Upon completion of the course, student should be able to

1. Realize the concepts of Analog MOS devices and current mirror circuits.
2. Design different configuration of Amplifiers and feedback circuits.
3. Analyze the characteristics of frequency response of the amplifier and its noise.
4. Analyze the performance of the stability and frequency compensation techniques of Op-Amp Circuits.
5. Construct switched capacitor circuits and PLLs.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	2	2	-	-	-	2	-	-	2	3	2	2
CO2	1	2	2	2	2	-	1	2	-	-	2	3	2	2
CO3	1	-	2	2	2	-	1	2	-	-	2	3	1	2
CO4	1	-	2	2	2	-	1	2	-	-	2	3	1	2
CO5	1	-	3	2	2	2	-	2	2	2	2	3	1	2

PROFESSIONAL ELECTIVES - IV

20ECEL805 SDG NO. 4	PHOTONIC NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the importance of the back bone infrastructure for our present and future communication needs
- To familiarize the student with the architectures and the protocol stack in use
- To understand the differences in the design of data plane and the control plane and the routing, switching and the resource allocation methods
- To understand the network management and protection methods in vogue
- To expose the student to the advances in networking and switching domains and the future trends

UNIT I OPTICAL SYSTEM COMPONENTS 9

Light Propagation in optical fibers – Loss & bandwidth, System limitations, Nonlinear effects; Solitons Optical Network Components–Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

UNIT II OPTICAL NETWORK ARCHITECTURES 9

Introduction to Optical Networks; SONET/SDH, Metropolitan - Area Networks, Layered Architecture; Broadcast and Select Networks – Topologies for Broadcast Networks, Media - Access Control Protocols, Wavelength Routing Architecture.

UNIT III WAVELENGTH ROUTING NETWORKS 9

The optical layer, Optical Network Nodes, Routing and wavelength assignment, Traffic Grooming in Optical Networks, Architectural variations-Linear Light wave networks, Logically Routed Networks.

UNIT IV PACKET SWITCHING AND ACCESS NETWORKS 9

Photonic Packet Switching – OTDM, Multiplexing and Demultiplexing, Synchronization, Broadcast OTDM networks, Switch-based networks, Contention Resolution Access Networks – Network Architecture overview, Optical Access Network Architectures and OTDM networks.

UNIT V NETWORK DESIGN AND MANAGEMENT 9

Transmission System Engineering–System model, Power penalty-transmitter,

receiver, Optical amplifiers, crosstalk, dispersion, Wavelength stabilization, Overall design considerations, Control and Management–Network management functions, Configuration management, Performance management, Fault management, Optical safety, Service interface.

TOTAL: 45 PERIODS

REFERENCES:

1. Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks: A Practical Perspective", Harcourt Asia Pte Ltd., 2nd Edition,2004.
2. C.Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks: Concept, Design and Algorithms", Prentice Hall of India, 1st Edition,2002.
3. P.E. Green, Jr., "Fiber Optic Networks", PrenticeHall,NJ,1993.
4. Biswanath Mukherjee, "Optical WDM Networks", Springer Series, 2006.

WEB REFERENCES:

1. https://www.fujitsu.com/global/about/resources/publications/fstj/archives/vol35-1.html
2. https://www.adva.com/en/innovation/photonic-networking

ONLINE RESOURCES:

1. https://moodle.telt.unsw.edu.au/login/index.php

OUTCOMES:

Upon completion of the course, the student should be able to

1. Use the back bone infrastructure for our present and future communication needs.
2. Analyze the architectures and the protocol stack.
3. Analyze the design of data plane and control plane.
4. Understand the protection methods in vogue .
5. Compare the differences in the design of data plane, control plane, routing, switching, resource allocation methods, network management and protection methods in vogue.

CO - PO, PSO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	2	-	2	-	3	2	2	3	2
CO2	3	2	3	2	1	2	-	2	-	3	2	2	3	2
CO3	3	2	3	2	-	2	1	2	-	3	2	2	3	2
CO4	3	2	3	2	3	2	-	2	-	3	2	2	3	2
CO5	3	2	3	2	3	2	-	2	2	3	2	2	3	2

PROFESSIONAL ELECTIVES - IV

20CSEL802 SDG NO. 9	DEEP LEARNING PRINCIPLES AND PRACTICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the concepts of Deep Learning
- To introduce Dimensionality Reduction techniques
- To illustrate Deep Learning techniques to support Real-time applications
- To examine the case studies of Deep Learning techniques

UNIT I INTRODUCTION **9**

Introduction to Machine Learning-Linear Models - SVMs –Perceptrons - Logistic Regression -Introduction to Neural Networks - Shallow Network - Training a Network - Loss Functions - Back Propagation and Stochastic Gradient Descent-Neural Networks as Universal Function.

UNIT II CONCEPTS OF DEEP LEARNING **9**

History of Deep Learning - Probabilistic Theory of Deep Learning - Back Propagation –Regularization -Batch Normalization-VC Dimension - Neural Networks-Deep Vs Shallow Networks-Convolutional Networks-Generative Adversarial Networks (GAN) - Semi-supervised Learning.

UNIT III METRIC LEARNING **9**

Principle Component Analysis – Linear Discriminant Analysis-Manifolds - Metric Learning -Auto Encoders -Dimensionality Reduction in Networks - Introduction to Convolution Network -Architectures –AlexNet – Visual Geometry Group –Inception– Residual Network.

UNIT IV OPTIMIZATION **9**

Optimization in Deep Learning–Non-Convex Optimization for Deep Networks-Stochastic Optimization-Generalization in Neural Networks-Spatial Transformer Networks-Recurrent networks – Long Short Term Memory -Recurrent Neural Network Language Models-Word Level.

UNIT V ADVANCED TECHNIQUES **9**

ImageNet - Object Detection - Audio WaveNet - Natural Language Processing - Word2Vec Model -Joint Detection-Bio Informatics-Face Recognition-Scene Understanding-Gathering Image Captions.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Cosma Rohilla Shalizi, "Advanced Data Analysis from an Elementary Point of View", Carnegie Mellon University, 2019.

2. Deng and Yu, "Deep Learning: Methods and Applications", Now Publishers, 2013.

REFERENCES:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Michael Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015.

WEB REFERENCES:

1. https://nptel.ac.in/courses/106105215/
2. https://nptel.ac.in/courses/106106201/
3. https://www.coursera.org/specializations/deep-learning

ONLINE RESOURCES:

1. https://www.simplilearn.com/deep-learning-tutorial
2. https://www.tutorialspoint.com/machine_learning/deep_machine_learning.htm

OUTCOMES:

Upon completion of the course, the students Should be able to

1. Differentiate various learning approaches and to interpret the concepts of Machine Learning.
2. Understand the history of Deep Learning and theory behind Deep Learning techniques and analyzing it.
3. Compare the different Dimensionality Reduction techniques and study about Convolution network technique.
4. Illustrate the working of Optimization techniques in Deep Learning.
5. Examine the case studies in Deep Learning and identify its applicability in real life problems.

CO- PO, PSO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	1	-	3	-	-	-	2	1	-	3	3	1
CO2	3	-	1	-	3	-	-	-	2	1	-	3	3	1
CO3	3	-	1	-	3	-	-	-	2	1	-	3	3	1
CO4	3	-	1	-	3	-	-	-	2	1	-	3	3	1
CO5	3	-	1	-	3	-	-	-	2	1	-	3	3	1

PROFESSIONAL ELECTIVES - IV

20HSMG301 SDG NO. 3,4,5,8,10, 13,14,15,16	PROFESSIONAL ETHICS AND VALUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objectives of this course are to provide students of engineering with:

- An understanding of their duties and responsibilities as professionals through gaining knowledge of the philosophies of ethics, professional practice, and world culture.
- Basic knowledge to make informed ethical decisions when confronted with problems in the working environment.
- Improved awareness of potential ethical issues within an engineering context.
- Team skills through working in teams on assignments and in-class assignments.
- Subjective analytical skills through investigation and evaluation of ethical problems in engineering settings using accepted tests for moral problem solving.
- An understanding of how societal morals vary with culture and its influence on ethical thought and action.
- Improved communications skills with regard to ethical and professional issues in engineering.
- Know some of the classic cases as well as contemporary issues in engineering ethics.

UNIT I HUMAN VALUES & PRINCIPLES FOR HARMONY 9

Morals, Values, and Ethics –Value Education – Human Dignity – Human Rights – Fundamental Duties – Aspirations and Harmony (I, We & Nature) – Gender Bias – Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness.

UNIT II ENGINEERING ETHICS AND SOCIAL EXPERIMENTATION 9

History of Ethics – Need of Engineering Ethics – Engineering Ethics - Profession and Professionalism - Self Interest – Moral Autonomy – Utilitarianism – Virtue Theory – Uses of Ethical Theories – Deontology- Types of Inquiry –Kohlberg's Theory – Gilligan's Argument – Heinz's Dilemma – Comparison with Standard Experiments –– Learning from the Past – Engineers as Managers – Role of Codes – Codes and Experimental Nature of Engineering.

UNIT III ENGINEERS' RESPONSIBILITIES TOWARDS SAFETY AND RISK 9

The concept of Safety – Safety and Risk – Types of Risks – Voluntary v/s Involuntary Risk – Consequences – Risk Assessment – Accountability – Liability – Reversible Effects – Threshold Levels of Risk – Delayed v/s Immediate Risk – Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis - Accidents.

UNIT IV ENGINEERS' DUTIES AND RIGHTS 9

Concept of Duty – Professional Duties – Collegiality – Professional and Individual Rights – Confidential and Proprietary Information – Conflict of Interest-Ethical egoism – Collective Bargaining – Confidentiality – Gifts and Bribes – Problem solving - Occupational Crimes - Industrial Espionage - Price Fixing-Whistle Blowing.

UNIT V GLOBAL ISSUES

Globalization and MNCs – Cross Culture Issues – Business Ethics – Media Ethics – Environmental Ethics – Endangering Lives – Bio Ethics – Computer Ethics – War Ethics – Research Ethics -Intellectual Property Rights.

TEXT BOOKS:

1. M.Govindarajan, S.Natarajan and V.S.SenthilKumar, "Engineering Ethics & Human Values", PHI Learning Pvt. Ltd., 2009.

REFERENCE BOOKS:

1. Sekhar, R.C., "Ethical Choices in Business Response Books", New Delhi, Sage Publications, 1997.
2. Kitson, Alan and Campebell, Robert, "The Ethical Organisation", Great Britain Macmillan Press Ltd., 1996.
3. Pinkus, Rosa Lyun B., Larry J Shulman, Norman Phummon, Harvey Wolfe, "Engineering Ethics",New York, Cambridge Uty., Press, 1997.
4. R. Subramaniam, "Professional Ethics", Oxford Publications, New Delhi.
5. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw-Hill – 2003.
6. Prof.A.R.Aryasri, Dharanikota Suyodhana, "Professional Ethics and Morals" Maruthi Publications.
7. Harris, Pritchard, and Rabins, "Engineering Ethics", Cengage Learning, New Delhi.
8. S. B. Gogate, "Human Values & Professional Ethics", Vikas Publishing House Pvt. Ltd., Noida.

9. A. Alavudeen, R.Kalil Rahman and M. Jayakumaran, "Professional Ethics and Human Values", University Science Press.
10. Prof.D.R.Kiran, "Professional Ethics and Human Values" Tata McGraw-Hill – 2013
11. Jayshree Suresh and B. S. Raghavan, "Human Values and Professional Ethics", S.Chand Publications.

WEB RESOURCES

- Ethos Education provides a concise guide on developing a code of ethics for primary and secondary schools.
- The Ethics Resource Center has a toolkit available for use. When used for commercial purposes, a nominal license fee is required.
- Creating A Code Of Ethics for Your Organization, with many suggested books, by Chris MacDonald.
- The Deloitte Center for Corporate Governance offers a variety of resources for those who are active in governance, including a variety of resources and a set of suggested guidelines for writing a code of ethics or a code of conduct.

MOOC REFERENCES:

- https://www.udemy.com/course/worlplace-ethics-and-attitude/
- https://www.udemy.com/course/business-ethics-how-to-create-an-ethical-organization/
- https://nptel.ac.in/courses/110/105/110105097/Ethics in Engineering Practice
- https://nptel.ac.in/courses/109/104/109104068/Human Values
- https://www.coursera.org/learn/ethics-technology-engineering
- https://www.classcentral.com/course/ethics-technology-engineering-10485

OUTCOMES:

Upon completion of the course, the students should be able to

1. Improved ability to distinguish between ethical and non-ethical situations.
2. The ability to practice moral judgment in conditions of dilemma.
3. The understanding to relate the code of ethics to social experimentation.
4. The knowledge to apply risk and safety measures in various engineering fields.
5. The broad education necessary to better understand the impact of engineering solutions in a global/societal context.

CO- PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	3	3	3	3	3	1	3
CO2	2	3	2	2	2	3	3	3	3	3	2	3
CO3	3	2	3	2	2	3	3	3	3	3	1	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	2	2	2	2	3	3	3	3	3	1	3

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The Sustainable Development Goals (SDGs) are a collection of 17 Global Goals that were adopted by all United Nations Member of States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030.

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College Campus
Sai Leo Nagar, West Tambaram,
Chennai - 600 044. Ph : 044-2251 2111

Administrative Office
"Sai Bhavan", 31B, Madley Road, T.Nagar,
Chennai - 600 017. Ph : 044-4226 7777

e-mail : sairam@sairamgroup.in

www.sairamgroup.in