CURRICULUM AND SYLLABI

FOR B.E. / B.Tech. DEGREE PROGRAMMES

(For the Students Admitted in the Academic Year 2019-2020 onwards)

B.E- ELECTRONICS AND COMMUNICATION ENGINEERING - FIRST SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
19HST101	Communicative Techno English - I	HS	3	0	0	3	40	60	100
19MAT101	Engineering Mathematics - I	BS	3	1	0	4	40	60	100
19CYE101	Engineering Chemistry	BS	3	0	2	4	40	60	100
19PHE101	Engineering Physics	BS	3	0	2	4	40	60	100
19GET101	Engineering Graphics	ES	3	0	0	3	40	60	100
19GEE101	Computer Fundamentals and Python Programming	ES	3	0	2	4	40	60	100
19EEC101	Life Skills for Engineers	EEC	0	0	2	0	100	-	100
19MDC101	Induction Program (2 Weeks)	MC	-	-	-	-	-	-	-
TOTAL CREDITS IN SEMESTER - I			22						

HS : Humanities and Social Sciences
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ES : Engineering Sciences
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PE : Professional Elective
OE : Open Elective
EEC : Employability Enhancement Courses
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ESE : End Semester Examination
TOT : Total

B.E- ELECTRONICS AND COMMUNICATION ENGINEERING - SECOND SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
19HST201	Communicative Techno English - II	HS	3	0	0	3	40	60	100
19CYT201	Environmental Science and Engineering	HS	3	0	0	3	40	60	100
19MAT201	Engineering Mathematics - II	BS	3	1	0	4	40	60	100
19PHT202	Solid State Physics and Nano Electronic Devices	BS	3	0	0	3	40	60	100
19GET203	Basic Civil and Mechanical Engineering	ES	3	0	0	3	40	60	100
19ECE201	Electronic Devices	PC	3	0	2	4	40	60	100
19EEC203	Technical Skill (Hands on training in Electrical & Electronics)	EEC	0	0	2	0	100	-	100
19MDC201	NSS / YRC / RRC	MC	-	-	-	-	100	-	100
TOTAL CREDITS IN SEMESTER - II			20						

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B.E- ELECTRONICS AND COMMUNICATION ENGINEERING -THIRD SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
19MAT301	Transforms and Partial Differential Equations	BS	3	1	0	4	40	60	100
19ECT301	Signals and Systems	PC	3	1	0	4	40	60	100
19EET304	Circuit Theory	PC	3	1	0	4	40	60	100
19ECE301	Digital Electronics	PC	3	0	2	4	40	60	100
19ECE302	Electronic Circuits	PC	3	0	2	4	40	60	100
19CSE303	Data structures using C	ES	3	0	2	4	40	60	100
19EEC301	Communication Skills	EEC	0	0	2	0	100	-	100
19MDC301	Leadership Enhancement Programme	MC	1	0	0	0	100	-	100
TOTAL CREDITS IN SEMESTER - III			24						

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B.E- ELECTRONICS AND COMMUNICATION ENGINEERING - FOURTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
19MAT402	Probability and Random Processes	BS	3	1	0	4	40	60	100
19ECT401	Electromagnetic Fields	PC	3	1	0	4	40	60	100
19ECT402	Measurements and Instrumentation	PC	3	0	0	3	40	60	100
19EET403	Control Systems Engineering	PC	3	1	0	4	40	60	100
19ECE401	Communication Theory	PC	3	0	2	4	40	60	100
19ECE402	Linear Integrated Circuits	PC	3	0	2	4	40	60	100
19EEC302	Entrepreneurship Development Activity	EEC	0	0	2	0	100	-	100
19MDC401	Value Added Course - I	MC	-	-	-	-	100	-	100
TOTAL CREDITS IN SEMESTER - IV			23						

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ESE : End Semester Examination
TOT : Total

B.E- ELECTRONICS AND COMMUNICATION ENGINEERING - FIFTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
19ECT501	Transmission Lines and Waveguides	PC	3	0	0	3	40	60	100
19ECT502	Soft Computing	PC	3	0	0	3	40	60	100
19ECE502	Digital Signal Processing	PC	3	0	2	4	40	60	100
19ECE503	Microprocessor and Microcontroller	PC	3	0	2	4	40	60	100
	Professional Elective - I	PE	3	0	0	3	40	60	100
	Open Elective - I	OE	3	0	0	3	40	60	100
19EEC501	Quantitative Aptitude Learning	EEC	0	2	0	0	100	-	100
19MDC501	Value Added Course - II	MC	-	-	-	-	100	-	100
TOTAL CREDITS IN SEMESTER - V			20						

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ESE : End Semester Examination
TOT : Total

B.E- ELECTRONICS AND COMMUNICATION ENGINEERING - SIXTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
19ECT601	Antennas and Wave Propagation	PC	3	1	0	4	40	60	100
19ECT602	Wireless Communication	PC	3	0	0	3	40	60	100
19ECT603	Communication Networks	PC	3	0	0	3	40	60	100
19ECE601	VLSI Design	PC	3	0	2	4	40	60	100
19ECE602	Digital Communication	PC	3	0	2	4	40	60	100
	Professional Elective - II	PE	3	0	0	3	40	60	100
19ECJ601	Mini Project	EEC	0	0	2	1	40	60	100
19MDC601	Constitution of India	MC	3	0	0	0	100	-	100
TOTAL CREDITS IN SEMESTER - VI			22						

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TOT : Total

B.E- ELECTRONICS AND COMMUNICATION ENGINEERING - SEVENTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
19ECT701	Optical Communication	PC	3	0	0	3	40	60	100
19ECE701	Microwave Engineering	PC	3	0	2	4	40	60	100
19ECE702	Embedded Systems	PC	3	0	2	4	40	60	100
	Open Elective - II	OE	3	0	0	3	40	60	100
19ECJ701	Project Phase - I	EEC	0	0	2	1	40	60	100
TOTAL CREDITS IN SEMESTER - VII			15						

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B.E- ELECTRONICS AND COMMUNICATION ENGINEERING - EIGHTH SEMESTER

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
	Professional Elective - III	PE	3	0	0	3	40	60	100
	Professional Elective - IV	PE	3	0	0	3	40	60	100
19ECJ801	Project Phase-II	EEC	0	0	20	10	40	60	100
TOTAL CREDITS IN SEMESTER - VIII			16						

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PE : Professional Elective
OE : Open Elective
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MC : Mandatory Courses
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TOT : Total

LIST OF PROFESSIONAL CORE (PC) COURSES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
19ECE201	Electronic Devices	PC	3	0	2	4	40	60	100
19ECT301	Signals and Systems	PC	3	1	0	4	40	60	100
19EET304	Circuit Theory	PC	3	1	0	4	40	60	100
19ECE301	Digital Electronics	PC	3	0	2	4	40	60	100
19ECE302	Electronic Circuits	PC	3	0	2	4	40	60	100
19ECT401	Electromagnetic Fields	PC	3	1	0	4	40	60	100
19ECT402	Measurements and Instrumentation	PC	3	0	0	3	40	60	100
19EET403	Control Systems Engineering	PC	3	1	0	4	40	60	100
19ECE401	Communication Theory	PC	3	0	2	4	40	60	100
19ECE402	Linear Integrated Circuits	PC	3	0	2	4	40	60	100
19ECT501	Transmission Lines and Waveguides	PC	3	0	0	3	40	60	100
19ECT502	Soft Computing	PC	3	0	0	3	40	60	100
19ECE502	Digital Signal Processing	PC	3	0	2	4	40	60	100
19ECE503	Microprocessor and Microcontroller	PC	3	0	2	4	40	60	100
19ECT601	Antennas and Wave Propagation	PC	3	1	0	4	40	60	100
19ECT602	Wireless Communication	PC	3	0	0	3	40	60	100
19ECT603	Communication Networks	PC	3	0	0	3	40	60	100
19ECE601	VLSI Design	PC	3	0	2	4	40	60	100
19ECE602	Digital Communication	PC	3	0	2	4	40	60	100
19ECT701	Optical Communication	PC	3	0	0	3	40	60	100
19ECE701	Microwave Engineering	PC	3	0	2	4	40	60	100
19ECE702	Embedded Systems	PC	3	0	2	4	40	60	100

LIST OF PROFESSIONAL ELECTIVE (PE) COURSES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
PROFESSIONAL ELECTIVE - I									
19ECPX01	Medical Electronics	PE	3	0	0	3	40	60	100
19ECPX02	Operating Systems	PE	3	0	0	3	40	60	100
19ECPX03	Robotics and Automation	PE	3	0	0	3	40	60	100
19ECPX04	Nano Technology and Applications	PE	3	0	0	3	40	60	100
19ECPX05	Total Quality Management	PE	3	0	0	3	40	60	100
19ECPX06	Cryptography and Network Security	PE	3	0	0	3	40	60	100
Course Code	**Name of the Subject**	**Category**	**Periods / Week**			**Credit**	**Maximum Marks**		
			L	**T**	**P**	**C**	**CIA**	**ESE**	**TOT**
PROFESSIONAL ELECTIVE - II									
19ECPX07	Computer Architecture	PE	3	0	0	3	40	60	100
19ECPX08	Multimedia Compression and Communication	PE	3	0	0	3	40	60	100
19ECPX09	CMOS Analog IC Design	PE	3	0	0	3	40	60	100
19ECPX10	Wireless Networks	PE	3	0	0	3	40	60	100
19ECPX11	Intellectual Property Rights	PE	3	0	0	3	40	60	100
19ECPX12	Foundation Skills in Integrated Product Development	PE	3	0	0	3	40	60	100

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
PROFESSIONAL ELECTIVE - III									
19ECPX13	Machine Learning Techniques	PE	3	0	0	3	40	60	100
19ECPX14	Deep Learning	PE	3	0	0	3	40	60	100
19ECPX15	Electro Magnetic Interference and Compatibility	PE	3	0	0	3	40	60	100
19ECPX16	Compressive Sensing	PE	3	0	0	3	40	60	100
19ECPX17	Digital Image Processing	PE	3	0	0	3	40	60	100
19ECPX18	Professional Ethics in Engineering	PE	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE - IV									
Course Code	**Name of the Subject**	**Category**	**Periods / Week**			**Credit**	**Maximum Marks**		
			L	**T**	**P**	**C**	**CIA**	**ESE**	**TOT**
19ECPX19	DSP Architecture and Programming	PE	3	0	0	3	40	60	100
19ECPX20	Satellite Communication	PE	3	0	0	3	40	60	100
19ECPX21	Disaster Management	PE	3	0	0	3	40	60	100
19ECPX22	Principles of Speech Processing	PE	3	0	0	3	40	60	100
19ECPX23	Designing with FPGAs	PE	3	0	0	3	40	60	100
19ECPX24	MEMS and NEMS	PE	3	0	0	3	40	60	100

B.E. - ECE : LIST OF OPEN ELECTIVE COURSES FOR OTHER BRANCHES

Course Code	Name of the Subject	Category	Periods / Week			Credit	Maximum Marks		
			L	T	P	C	CIA	ESE	TOT
OPEN ELECTIVE - I									
19ECOX01	Internet of Things	OE	3	0	0	3	40	60	100
19ECOX02	Advanced Wireless Communication	OE	3	0	0	3	40	60	100
19ECOX03	Cognitive Radio	OE	3	0	0	3	40	60	100
19ECOX04	Electronics Packaging andTesting	OE	3	0	0	3	40	60	100
19ECOX05	Low power SoC Design	OE	3	0	0	3	40	60	100
OPEN ELECTIVE - II									
Course Code	**Name of the Subject**	**Category**	**Periods / Week**			**Credit**	**Maximum Marks**		
			L	**T**	**P**	**C**	**CIA**	**ESE**	**TOT**
19ECOX06	Photonic Networks	OE	3	0	0	3	40	60	100
19ECOX07	Video Analytics	OE	3	0	0	3	40	60	100
19ECOX08	Fundamentals of Nano Science	OE	3	0	0	3	40	60	100
19ECOX09	Automotive Infotronics	OE	3	0	0	3	40	60	100
19ECOX10	Telecommunication switching Networks	OE	3	0	0	3	40	60	100

SCHEME FOR SYLLABI

B.E.-ECE

SENGUNTHAR
Shrine 2 Success

SEMESTER I

19HST101	**COMMUNICATIVE TECHNO ENGLISH – I** (Common to Civil, CSE, ECE, EEE & Mechanical)	**L T P C** **3 0 0 3**

OBJECTIVES

To enable students to:

- Understand the basics of the English Language in a graded manner.
- Enrich vocabulary for the development of all the four language skills (LSRW).
- Develop speaking skills through self introduction and delivering speeches**.**
- Write e-mails, informal letters.
- Improve writing skills to express thoughts freely.

UNIT I: VOCABULARY **8**

Synonyms and Antonyms - Single Word Substitutes - Use of Abbreviations and Acronyms- Homonyms and Homophones- Business Vocabulary - Commonly Confused Words- Collocation - British and American Vocabulary- Word formation. Activity: Grammar worksheets on the given topics.

UNIT II: GRAMMAR **10**

Parts of speech - Comparative Adjectives - Numerical Adjectives - Be, Have and Do verbs- modal verbs-Types of Questions - Tenses - Impersonal Passive Voice - Direct and Indirect Speech- Gerunds and Infinitives - Same Word Used as Different Parts of Speech.

Activity: Grammar worksheets on the given topics.

UNIT III: INFORMAL WRITING **9**

Letter Writing - Informal Letters - e-mail Writing - Informal Dialogues - Essay Writing- InformalEssays- Movie Reviews -Writing Instructions.

Activity: Giving topic and ask the students to write informal letters, e-mail.

UNIT IV: LANGUAGE ENHANCEMENT THROUGH SPEAKING **9**

Self Introduction - (exchanging personal information) personal information, hobbies, strengths and weaknesses, likes and dislikes, special features of home town. Narrating Personal Experiences and Incidents- Two minute talk- Debate discussion.

Activity: Ask the students to speak about the above given topics.

UNIT V: READING SKILLS **9**

Reading Comprehension - reading techniques, pre-reading, post-reading, comprehension questions (multiple choice questions or short questions) - Short comprehension passages,

Practice skimming-scanning and predicting - Reading the passage and taking (Note making)Notes- Scan and understand main contents of the passage.

Activity: Giving topic and ask the students to find out answers for given passage**.**

TOTAL: 45 PERIODS

OUTCOMES

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

- Learn to acquire usage of English.
- Use a wide range of vocabulary in oral and written communication.
- Give short informal presentations and participate in classroom discussions.
- Write informal letters and other communications.
- Frame grammatically correct sentences.

TEXT BOOKS

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

REFERENCES

1. Department of English, Anna University, "Mindscapes: English for Technologists and Engineers", 1st Edition, Orient Black Swan, Chennai. 2012.
2. Title: Developing Communication Skills. Publisher: MacMillan. Author: Krishna Mohan,Meera Banerji. Edition: Paperback 20

E-RESOURCES

1. https://nptel.ac.in/courses/109/106/109106094/ - (Introduction to Vocabulory)
2. https://nptel.ac.in/courses/109/106/109106129/ - (Reading Comprehension)

19MAT101 **ENGINEERING MATHEMATICS - I** **L T P C**
(Common to Civil, CSE, ECE, EEE & Mechanical) **3 1 0 4**

OBJECTIVES

To enable students to:

- Develop the use of matrix algebra techniques that is needed by engineering forpractical applications.
- Introduce the basic concepts of functions, limit of function, continuity, derivaties and extreme values.
- Provide the basic tools of calculus mainly for the purpose ofmodelling the engineering problems mathematically and obtaining solutions.
- Make the basic concepts of definite, indefinite, improper integrals and Bernoulli's formula.
- Acquaint the student with mathematical tools needed in evaluating multiple integralsand their usage.

UNIT I: MATRICES **9+3**

Eigen values and Eigenvectors of a real matrix - Characteristic equation - Properties of Eigenvalues and Eigenvectors - Cayley-Hamilton theorem - Diagonalization of matrices - Reduction of a quadratic form to canonical form by orthogonal transformation - Nature of quadratic forms.

UNIT II: DIFFERENTIAL CALCULUS **9+3**

Representation of function - Limit of a function - Continuity - Derivatives - Differentiationrule - Maximum and Minimum values - absolute Maximum and Minimum - local Maximumand Minimum.

UNIT III: FUNCTIONS OF SEVERAL VARIABLES **9+3**

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

UNIT IV: INTEGRAL CALCULUS **9+3**

Definite and Indefinite integral - Substitution rule - Integration by parts - Trigoniometric substitutions - Integration of rational function by partial fraction - Improper integrals - Bernoulli's formula**.**

UNIT V: MULTIPLE INTEGRALS **9+3**

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 indouble and triple integrals.

TOTAL: 45+15=60 PERIODS

OUTCOMES

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Understanding of the ideas of matrix and its nature.
- Apply differentiation to solve maxima and minima problems.
- Understanding the concept of Partial differentiation and Total derivative.
- Evaluate integrals using techniques of integration such as substitution, partial fractionsand integration by parts.
- Apply integration to compute multiple integrals, area, volume, integrals in polarco-ordinates, in addition to change of order and change of variables.

TEXT BOOKS

1. Grewal B.S., " Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.

REFERENCES

1. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. Jain R.K. and Iyengar S.R.K., — Advanced Engineering Mathematics, Narosa Publications, New Delhi, 3rd Edition, 2007.

E-RESOURCES

1. https://nptel.ac.in/courses/111/105/111105121/ - (Rolle`s Theorem)
2. https://nptel.ac.in/courses/111/105/111105035/ - (Linear Algebra)

19CYE101	ENGINEERING CHEMISTRY (Lab Embedded Theory Course) (Common to Civil, CSE, ECE, EEE & Mechanical)	L T P C 3 0 2 4

OBJECTIVES

To enable students to:

- Classify the impurities of water and know the treatment and the conditioning methods for domestic and industrial uses.
- Develop an understanding about fundamentals of polymers.
- Be familiar with the types of corrosion and control measures and working of batteries.
- Gain knowledge about the phase rule and its applications to engineering field.
- Explain the basics of Nanochemistry, synthesis, properties and applications of Nano materials.
- Acquire practical skills in the determination of water quality parameters, molecular weight of polymer, rate corrosion through volumetric and instrumental analysis.

UNIT I: WATER TECHNOLOGY **9**

Introduction - Characteristics - hardness - estimation of hardness by EDTA method - alkalinity and its estimation - Boiler feed water - requirements - Boilers troubles (Scale and Sludge) - Internal conditioning (colloidal - phosphate - calgon and carbonate conditioning methods) - External conditioning - zeolite process, demineralization process - Desalination of brackish water by reverse osmosis - Municipality water treatment - Break point chlorination.

UNIT II: POLYMER CHEMISTRY **9**

Introduction - Classification of polymers - Natural and synthetic; Thermoplastic and Thermosetting. Functionality - Degree of polymerization. Types of polymerization: Addition condensation and copolymerization, Properties of polymers: Tg, Tacticity, Molecular weight - weight average, number average and polydispersity index. Preparation, properties and uses of PVC, Nylon 6,6, Polyethylene - Rubbers - types - vulcanization of rubber - Plastics - Moulding constituents of plastics - Moulding of plastics - compression, injection and blow moulding- Biodegradable polymers-Conducting polymers.

UNIT III: CORROSION AND BATTERY TECHNOLOGY **9**

Corrosion - Types - Chemical Corrosion - Electrochemical Corrosion (galvanic and differential aeration) - Factors influencing corrosion - Material selection and design aspects - control

methods of corrosion - Sacrificial anodic and impressed current cathodic protection -Protective coatings - paints - constituents and their functions - electroplating of Copper - electroless plating of Nickel. Batteries: Definition, Types - example, Lead acid battery, Lithiumion battery - H2 - O2 fuel cell- solar cell.

UNIT IV: PHASE RULE AND ALLOYS **9**

Phase rule - explanation of terms involved - one component system - water system - condensed phase rule - construction of phase diagram by thermal analysis - simple eutectic systems (lead - silver system only).Alloys: Introduction- definition- properties of alloys- significance of alloying, functions and effect of alloying elements - ferrous alloys - nichrome and stainless steel - heat treatment of steel, non-ferrous alloys - brass and bronze.

UNIT V: CHEMISTRY OF NANO MATERIALS **9**

Nano chemistry - Basics (Surface area to volume ratio - Quantum confinement - (0D, 1D, 2D &3D) - Distinction between Molecules, Nanoparticles and Bulk Materials - Characterisation of nano materials using XRD and SEM. Synthesis of nano materials: Top down approach - Ball milling - Bottom up approach - Sol-gel method, Chemical vapour deposition - Properties of nanomaterials and Applications of Nanomaterials (Nano products of today).

LIST OF EXPERIMENTS

(Any Eight Experiments to be conducted)

1. Determination of total, temporary & permanent hardness of water by EDTA method.
2. Determination of alkalinity in water sample.
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. Estimation of sodium and potassium present in water using flame photometer.
7. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
8. Conductometric titration of strong acid vs strong base.
9. Corrosion experiment-weight loss method.
10. Estimation of copper content in the brass by Iodometry.

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Identify the method of removal of impurities from water for domestic and industrial purpose.
- Identify the different types of polymers, polymerisation processes and some special properties and applications of polymers.
- Analyze the causes of corrosion and discuss the control measures and discuss the functions of batteries.
- Apply of phase rule to alloy making for various engineering applications.
- Discuss the fundamentals of the nano materials and nano products of today.
- Outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TEXT BOOKS

1. Jain P.C and Monika Jain, "Engineering Chemistry", Dhanpet Rai Publishing Company(P) Ltd.,New Delhi, 2013.
2. Viswanathan B, "Nanomaterials" Alpha Science International Ltd, 2009.

REFERENCES

1. S. S. Dara and S. S. Umare, "A Textbook of Engineering Chemistry", S. Chand &Company LTD, New Delhi, 2015.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd,New Delhi, 2012.

E-RESOURCES

1. https://nptel.ac.in/downloads/122101001/ - (Corrosion)
2. https://nptel.ac.in/courses/122/101/122101001/ - (Atomic Structure)

19PHE101	ENGINEERING PHYSICS	L T P C
	(Lab Embedded Theory Course)	3 0 2 4
	(Common to Civil, CSE, ECE, EEE & Mechanical)	

OBJECTIVES

The main objective of this course is to:

- Recognize different lattices and crystal structures.
- Be aware of the basic concepts of stress and strain.
- Know the basics of photonics and its applications.
- Make known the principles of quantum theory.
- Understand the applications of acoustics and ultrasonics in industry.
- Demonstrate experiments to understand basic of Engineering Physics concepts to be applied in optics, thermal physics, properties of matter and liquids.

UNIT I: STRUCTURE OF SOLIDS **9**

Lattice - Unit cell - Bravais lattice - Lattice planes - Miller indices - d -Spacing in Cubic lattice -Calculation of number of atoms per unit cell - Atomic radius - Coordination number - Packing factor for SC, BCC, FCC and HCP structures - Crystal Growth Techniques - Solution, melt (Bridgman and Czochralski) and Vapour growth techniques(qualitative).

UNIT II: ELASTICITY **9**

Elasticity - Stress-Strain diagram and its uses - Factors affecting elastic modulus and tensile strength - Torsional stress and deformations - Twisting couple - 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.

UNIT III: PHOTONICS **9**

Introduction to interaction of radiation with matter- Spontaneous and Stimulated emission- Population Inversion - Derivation of Einstein's A and B coefficients – Principle and working of Laser - Nd:YAG laser - Direct bandgap and indirect bandgap semiconductors - Semiconductor diode Laser- Principle and propagation light in optical fibres- Derivation of Numerical aperture and Acceptance angle - Fibre optic communication system.

UNIT IV: QUANTUM PHYSICS **9**

Black body radiation - Planck's theory (derivation) - Compton effect: theory and experimental verification - Wave particle duality - Electron diffraction - Concept of wave function and its Physical significance - Schrödinger's wave equation: Time independent and time dependent equations - Particle in a one-dimensional rigid box- Quantum Tunneling- Tunneling Electron Microscope.

UNIT V: ACOUSTICS AND ULTRASONICS **9**

Classification of sound- decibel- Weber - Fechner law - Sabine's formula - Derivation using growth and decay method - Absorption Coefficient and its determination - Factors affecting acoustics of buildings and their remedies Introduction- Classification of Sound waves - Production of Ultrasonic's by magnetostriction and piezoelectric methods - Acoustic grating - Cavitation - Applications of Ultrasonics,

LIST OF EXPERIMENTS

(Any Eight Experiments to be Conducted)

1. Laser: Determination of wavelength of laser and particle Size.
2. Fiber Optics: Determination of Numerical Aperture and Acceptance angle.
3. Determination of bandgap of semiconductor.
4. Determination of wavelength of mercury spectrum- Spectrometer.
5. Determination of Youngs modulus - Non- Uniform bending.
6. Determination of Youngs modulus - Uniform bending.
7. Torsional Pendulum: Determination of moment of inertia and rigidity modulus.
8. Determination of velocity of ultrasonic in liquid.
9. Determination of Thickness of a thin wire - Air Wedge.
10. Determination of Viscosity of a liquid - Poiseulle's Method.

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Apply these basic principles of structures of Engineering materials.
- Make use of materials properties using the knowledge of Elasticity.
- Acquire the concepts of light propagation and its applications in lasers and fibre optics.
- Realize advanced physics concepts of quantum theory and its applications.
- Incorporate the Acoustics and ultrasound applications.
- Apply principles of elasticity, optics and acoustic properties in engineering applications.

TEXT BOOKS

1. Avadhanulu M.N&Kshirsagar P.G "Text Bookof Engineering Physics".S.Chand,2006.
2. P.Mani, "Engineering Physics Practicals", Dhanam Publications, 2019.

REFERENCES

1. Raghavan V, Materials Science and Engineering: A First Course, PHI Publications, 2015.
2. Rajendran V. "Engineering Physics". Tata McGraw Hill Publications, 2012.

E-RESOURCES

1. https://nptel.ac.in/courses/122107035/ (Polarization)
2. https://ocw.mit.edu/courses/physics/ (Introduction)

19GET101	ENGINEERING GRAPHICS (Common to Civil, CSE, ECE, EEE & Mechanical)	L T P C 3 0 0 3

OBJECTIVES

The main objective of this course is to:

- Understand the principles in graphic skill to communicate the concepts, ideas and design of engineering components.
- Learn projections of points, lines, planes viewed in different positions.
- Learn the projection of solids viewed in different positions.
- Gain the knowledge about the section of solids and development of surfaces of the given solids.
- Expose the international standards of technical drawing.

UNIT I: GENERAL PRINCIPLES OF ORTHOGRAPHIC PROJECTION 9

Graphics significance in engineering applications - study of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - principle of Letter writing and dimensioning. Projections of points, lines and planes. Principles of orthographic projection - First angle projection only - Layout of views - Projection of points located in all quadrant - Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT II: PROJECTION OF SOLIDS 9

Projections of solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT III: SECTION OF SIMPLE SOLIDS 9

Section of solids - prisms, pyramids, cylinder and cone. Obtaining sectional views and true shape when the axis of the solid is vertical and cutting plane inclined to one reference plane.

UNIT IV: DEVELOPMENT OF SURFACES 9

Development of lateral surfaces of simple and truncated solids - prisms, pyramids, cylinders and cones with cutout, perpendicular and inclined to the horizontal axis.

UNIT V: ISOMETRIC AND PERSPECTIVE PROJECTIONS 9

Principles of isometric projection - isometric scale - isometric projections of simple solids, truncated prisms, pyramids, cylinders and cones. Conversion of isometric projection into orthographic projection. Perspective projection of prisms, pyramids and cylinders by visual ray method.

TOTAL: 45 PERIODS

OUTCOMES

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

- Construct multiple views of engineering components.
- Prepare the pictorial drawings as per the standards.
- Develop the projection of solids.
- Draw the section of solids drawings and development of surfaces of given objects.
- Apply free hand sketching and concept of isometric in engineering practice.

TEXT BOOKS

1. Venugopal K. and Prabhu Raja V., - "Engineering Graphics", 15th Edition, New Age International (P) Limited, New Delhi, 2018.
2. Natarajan K.V., "Engineering Graphics", 32nd Edition, Dhanalakshmi Publishers, Chennai, 2019.

REFERENCES

1. K.R. Gopalakrishna, "Engineering Drawing Volume 1 & 2", 55th Edition SubhasPublications, Bangalore, 2017.
2. T.Jeyapoovan., "Engineering Graphics using Auto CAD" third edition vikas publishinghouse Pvt Ltd, New Delhi, 2017.

E - RESOURCES

1. https://nptel.ac.in/courses/112/103/112103019/ - (Geometric Constructions)
2. https://nptel.ac.in/courses/105/104/105104148/ - (Projections)

19GEE101 COMPUTER FUNDAMENTALS AND PYTHON PROGRAMMING L T P C
(Lab Embedded Theory Course) **3 0 2 4**
(Common to Civil, CSE, ECE, EEE & Mechanical)

OBJECTIVES

The course objectives are to:

- Enable the student to learn the major components of a computer system and software.
- Know the basics of algorithmic problem solving and fundamentals of python programming.
- Develop simple python programs.
- Define controls and functions in python.
- Use python data structures - lists, tuples and dictionaries.

UNIT I: INTRODUCTION 9

Introduction, Characteristics of Computers, Generation and Classifications of Computers, Basic Computer Organization, Computer Software, Types of Software, Software Development Steps, Internet, Getting connected to Internet Applications.

UNIT II: PROBLEM SOLVING AND PYTHON FUNDAMENTALS 9

Algorithms, building blocks of algorithms (instructions/statements, state, control f low, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Introduction to Python: Basics of Python and history of Python - Unique features of Python, interpreter and interactive mode - values and types: int, float, boolean, string, and list; variables.

UNIT III: EXPRESSIONS AND STATEMENTS 9

Expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT IV: CONTROL FLOW AND FUNCTIONS 9

Conditionals: Boolean values and operators, conditional (if), alternative (if -else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions, Strings, Lists as arrays. Illustrative programs: square root, gcd, Tower of Hanoi, exponentiation, sum an array of numbers, linear search, binary search.

UNIT V: LISTS, TUPLES AND DICTIONARIES 9

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.

LIST OF EXPERIMENTS

1. Document Creation, Table Creation and Flow chart.
2. Spread sheet- Chart, Formula, Sorting.
3. Compute the GCD of two numbers.
4. Find the square root of a number (Newton's method).
5. Exponentiation (power of a number).
6. Find the maximum of a list of numbers
7. Linear search and Binary search.
8. First n prime numbers.
9. Multiplication of two matrices.
10. Simulate elliptical orbits in Pygame.

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Know the Computer basics, Components and Software's
- Develop algorithmic solutions to simple computational problems and Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
- Represent compound data using Python lists, tuples, and dictionaries.

TEXT BOOKS

1. Ashok.N.Kamthane," Computer Programming", Pearson Education (India),(2015).
2. Allen B. Downey, ''Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python3, Shroff /O'Reilly Publishers,2016 http://green tea press.com/wp/think- python/).

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. Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.

E-RESOURCES

1. https://nptel.ac.in/courses/106/106/106106145/ - (Introduction to Algorithms)
2. https://nptel.ac.in/courses/106/106/106106182/ - (Joy of Computing)

19EEC101 **LIFE SKILLS FOR ENGINEERS** **L T P C**
(Employability Enhancement Course) **0 0 2 0**
(Common to Civil,CSE,ECE,EEE & Mechanical)

OBJECTIVES

To enable students to:

- Develop communication competence for engineers and enable them to convey thoughts and ideas with clarity and focus.
- Inculcate critical thinking process on problem solving.
- Have an overview on career skills required in their profession.
- Learn professional Ethics and Moral values.
- Lead a team with more responsibilities to be succeed in their endeavour.

UNIT I: COMMUNICATION SKILL **6**

Introduction to Communication, The Process of Communication, Barriers to Communication, Listening Skills, Non-verbal Communication and Body Language, Interview Skills, Group Discussion, Presentation Skills, Technology-based Communication- Technical Presentation

UNIT II: CRITICAL THINKING & PROBLEM SOLVING **6**

Creativity, Lateral thinking, Critical thinking, Multiple Intelligence, Problem Solving, Mind Mapping & Analytical Thinking.

UNIT III: CAREER SKILLS **6**

Introduction to Employability and Career Skills - developing a long - term career plan - making career changes -Time Management - General awareness of Current Affairs - Stress management - Leadership straits - Team work - Career planning.

UNIT IV: ETHICS MORAL & PROFESSIONAL VALUES **6**

Human Values, Civic Rights, Engineering Ethics, Engineering as Social Experimentation, Environmental Ethics, Global Issues.

UNIT V: LEADERSHIP SKILLS **6**

Leadership, Levels of Leadership, Making of a leader, Types of leadership, Transactions Vs Transformational Leadership, VUCA Leaders, DART Leadership, Leadership Grid & leadership Formulation.

TOTAL: 30 PERIODS

OUTCOMES

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

- Communicate effectively and make effective presentations.
- Write different types of reports.
- Face interview & group discussion.
- Critically think on a particular problem.
- Get success in all aspects and develop public skills.

TEXT BOOKS

1. Life Skills for Engineers, McGraw Hill Education (India) Private Ltd., 2016.
2. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015.

REFERENCES

1. Barun K. Mitra; (2011), "Personality Development & Soft Skills", 1st Edition; Oxford Publishers.
2. Kalyana; (2015) "Soft Skill for Managers"; 1st Edition; Wiley Publishing Ltd.

SEMESTER II

19HST201	COMMUNICATIVE TECHNO ENGLISH - II (Common to Civil, CSE, ECE, EEE & Mechanical)	L T P C 3 0 0 3

OBJECTIVES

To enable students to:

- Acquire usage of grammar in English language.
- Enhance the reading skill to comprehend technical writing.
- Improve business writing skills.
- Develop presentation skills in analytical view.
- Help learners to develop their speaking skills and speak fluently in real contexts

UNIT I: GRAMMAR **9**

Compound words - prepositions- articles- conditionals - Direct and indirect speeches-subject verb agreement-active and passive voice.

Activity: Grammar worksheets on the given topics.

UNIT II: LANGUAGE ENHANCEMENT THROUGH LISTENING & READING **9**

Syllabification - sentence stress - Intonation - Listening to You Tube Documentaries- Reading Vocabulary-Reading News Papers- Reading short stories.

Activity: Playing video & TED and identifying stress and intonation.

UNIT III: BUSINESS WRITING **9**

Writing Recommendations - Checklist- Business Letters - Calling for Quotations, Placing Orders, Letter of Complaint, Letter of Clarification - Cover Letter with Résumé- Report Writing - Accident Report, Industrial Visit Report, Survey Report and Feasibility Report.

Activity: Giving topic and ask the students to prepare checklist and complaint.

UNIT IV: WRITING **9**

Transcoding Graphics - Bar Chart, Flow Chart, Pie Chart and Tables- - Tour Itinerary - Process Description- Agenda and Minutes of meeting.

Activity: Giving charts to the students and ask them to transcode.

UNIT V: SPEAKING **9**

Collaborative task - Turn taking (initiating and responding appropriately) - Negotiating - Exchanging - suggesting - comparing and contrasting - expressing - Finding out facts, attitudes and opinions - Commonly mispronounced words.

TOTAL: 45 PERIODS

OUTCOMES

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

- Acquire advanced level gramatical knowledge.
- Improve their language usage in LSRW skills.
- Speak fluently using a wide range of vocabulary.
- Acquire the ability to understand different written texts.
- Enhance the writing skills to express the ideas in the business contexts.

TEXT BOOKS

1. Title: Technical English II Author: S. Sumant Maven Learning.
2. Communicative English by KN Shoba ,Lourdes Joavani Rayen Publised by Cambridge university 2017.

REFERENCES

1. Dr K Elango, Dr. Veena Selvam, Dr. Sujatha Priyadarshini, "Resonance English for Engineers and Technologists".Cambridge University Press, 1st Edition, Foundation Books,New Delhi, 2013.
2. Seely, John. Oxford Guide to Effective Writing and Speaking. Indian ed. New Delhi: Oxford University Press. 2005.

E-RESOURCES

1. https://nptel.ac.in/courses/109/104/109104031/- (Verbal and Non Verbal Communication)
2. https://nptel.ac.in/courses/109/106/109106094/ - (Technical English for Engineers)

19CYT201 **ENVIRONMENTAL SCIENCE AND ENGINEERING** **L T P C**
(Common to Civil, CSE, ECE, EEE & Mechanical) **3 0 0 3**

OBJECTIVES

To enable students to:

- Understand the importance of the environment and interrelationship between living organism and environment.
- Understand the various kinds of pollutions.
- Gain knowledge about natural resources and resource management.
- Be familiar with the social issues to improve the quality of environment.
- Gain knowledge about biodiversity,waste management and population explosion.

Unit I: ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY **11**

Definition, scope and importance of environment - need for public awareness - concept of an ecosystem - structure and function of an ecosystem - producers, consumers and decomposers food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, rivers, oceans) - Introduction to biodiversity definition: genetic, species and ecosystem diversity - biogeographical classification of India - value of biodiversity India as a mega-diversity nation - hot-spots of biodiversity
- threats to biodiversity - endangered and endemic species of India - conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Activity: Biodiversity in and around the campus and report submission.

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 - e-waste - role of an individual in prevention of pollution - pollution case studies - disaster management: floods, earthquake and cyclone.

Activity: Local Pollution Case Study and report submission.

UNIT III: NATURAL RESOURCES **10**

Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people - Water resources: Use and over- utilization of surface and ground water,

floods, drought, conflicts over water, dams-benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies - Food resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies - Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification - role of an individual in conservation of natural resources.

Activity: Waste to wealth.

UNIT IV: SOCIAL ISSUES AND THE ENVIRONMENT 9

From unsustainable to sustainable development - water conservation, rain water harvesting, watershed management - resettlement and rehabilitation of people; its problems and concerns, case studies - environmental ethics: Issues and possible solutions - climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. - wasteland reclamation - Green Chemistry and principles - environment production act - Air (Prevention and Control of Pollution) act - Water (Prevention and control of Pollution) act - Wildlife protection act - Forest conservation act - Public awareness.

Activity: Creating Environmental Awareness.

UNIT V: HUMAN POPULATION AND THE ENVIRONMENT 6

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

Activity: Visit to local primary health center.

TOTAL: 45 PERIODS

OUTCOMES

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

- Find scientific, technological, economic and political solutions to environmental problems.
- Invent innovative solutions for pollutions to improve the quality of environment.
- Participate the conservation of natural resources to save earth.
- Promote sustainable development and understand the concept of green chemistry.
- Analyse the effects of human population and issues related to the environment and human health.

TEXT BOOKS

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. Erach Bharucha, 'Textbook of Environmental Studies', Universities Press(I) Pvt Ltd,Hydrabad, 2015.
2. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, 2007

E-RESOURCES

1. https://nptel.ac.in/courses/122102006/ - (Nature of Environment)
2. https://nptel.ac.in/courses/127/105/127105018/-(SustainabilityConcepts)

19MAT201 **ENGINEERING MATHEMATICS - II** **L T P C**
(Common to Civil, CSE, ECE, EEE & Mechanical) **3 1 0 4**

OBJECTIVES

The Course objectives are to:

- Acquire sound knowledge of techniques in solving Ordinary Differential Equations that model engineering problem.
- Acquaint the concepts of vector calculus, needed for problems in all engineering disciplines.
- Understand the concept of bilinear transform and analytic functions.
- Understand the standard techniques of complex integration.
- Use Laplace transforms for solving the problems efficiently that occur in various branches of engineering disciplines.

UNIT I: DIFFERENTIAL EQUATIONS **9+3**

Higher order linear differential equations with constant coefficients - Method of variation of parameters - Homogenous equation of Euler's and Legendre's type - System of simultaneous linear differential equations with constant coefficients.

UNIT II: VECTOR CALCULUS **9+3**

Gradient and directional derivative - Divergence and curl - Line integral over a plane curve - Surface integral - Area of a curved surface - volume integral - Green's, Gauss divergence and Stoke's theorems - Verification and application in evaluating line, surface and volume integrals.

UNIT III: ANALYTIC FUNCTIONS **9+3**

Analytic functions - Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates - Properties - Harmonic conjugates - Construction of analytic function - Conformal mapping - Mapping by function $W = \frac{1}{z}$ Bilinear transformation.

UNIT IV: COMPLEX INTEGRATION **9+3**

Cauchy's integral theorem - Cauchy's integral formula - Laurent's series - Application of residue theorem for evaluation of real integrals - Use of circular contour and semicircular contour.

UNIT V: LAPLACE TRANSFORMS **9+3**

Existence conditions - Transforms of elementary functions - Transform of unit step function and unit impulse function - Basic properties - Shifting theorems -Transforms of derivatives and integrals - Inverse transforms - Convolution theorem - Transform of periodic functions- Application to solution of linear second order ordinary differential equations with constant coefficients.

TOTAL: 45+15=60 PERIODS

OUTCOMES

After successfully completing the course, the student will have a good understanding of the following topics and their applications

- Higher order linear differential equations with constant coefficients and variable coefficient.
- Green's,Gauss divergence and Stoke's theorems - Verification and application.
- Analytic functions, conformal mapping and Bilinear transformation..
- Application of residue theorem for evaluation of real integrals on contour integral.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.

REFERENCES

1. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, Delhi, 10th Edition, New 2016.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.

E-RESOURCES

1. https://nptel.ac.in/courses/111/105/111105134/ - (Vector Functions)
2. https://nptel.ac.in/courses/122/107/122107036/ - (Complex Integration)

19PHT202 **SOLID STATE PHYSICS AND NANOELECTRONIC DEVICES** **L T P C**
(Common to CSE, ECE and EEE branches) **3 0 0 3**

OBJECTIVES

The main objectives of this course are to:

- Learn the basic conduction process in conducting materials
- Understand the fundamentals of semiconducting materials.
- Develop the knowledge in Superconducting and Dielectric materials
- Aware of the propagation of light phenomenon in optical materials.
- Comprehend the concept of Nano Electronic Devices.

UNIT I: CONDUCTING MATERIALS **9**

Conductors - Classical free electron theory of metals - Electrical and thermal conductivity - Wiedemann - Franz law , Lorentz number - Draw backs of classical theory - Ohm's law verification - Fermi Dirac distribution function - Effect of temperature on Fermi Function - Density of energy states - Carrier concentration in metal - Average energy of an electron. Effective mass of electron and Concept of hole.

UNIT II: SEMICONDUCTING MATERIALS **9**

Elemental and compound semiconductors - Intrinsic semiconductor - Carrier concentration derivation - Fermi level - Derivation of carrier concentration in n-type and p-type semiconductor - Hall effect and applications .- Working of PN junction diode – Schottky diode- Ohmic contacts- Tunnel diode.

UNIT III: SUPERCONDUCTING AND DIELECTRIC MATERIALS **9**

Superconductivity: Properties - Type I and Type II superconductors - BCS theory of superconductivity - High Tc superconductors - General applications of superconductors - Cryotron and Magnetic levitation. **Dielectric Materials**: Electrical susceptibility - Dielectric constant - Electronic, ionic, orientation and space charge polarization- Internal filed and Clausius-Mosotti Relation - Ferro electricity and applications.

UNIT IV: OPTICAL MATERIALS **9**

Introduction-optical materials - Carrier generation and recombination processes - Solar cell - Photo detectors-PIN diode - Light Emitting Diode (LED) - Organic Light Emitting Diode (OLED) - Laser diode - Liquid Crystal Display (LCD) - Excitons- - Optical data storage techniques -Plasmonics.

UNIT V: NANO ELECTRONIC DEVICES **9**

Introduction- Quantum confinement- Quantum well, quantum wire and quantum dot structure - Tunneling: single electron phenomena and single electron transistor (SET) - Quantum dot laser- quantum bits (qubits)- quantum computing- Carbon Nano Tubes (CNT) structure, properties and applications. Concepts of Molecular Transisitor- Graphene Transistor - Carbon nano tube transistor -Applications of Nanodevices and Nanosensors.

TOTAL: 45 PERIODS

OUTCOMES

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

- Gain knowledge on classical and quantum electron theories, and energy bandstructures.
- Acquire knowledge on basics of semiconductor physics and its applications in various devices.
- Get knowledge on superconducting and dielectric properties of materials.
- Understand the function of optical materials for optoelectronics.
- Expand the knowledge on quantum structures and their applications in spintronics and Nano electronics.

TEXT BOOKS

1. Kasap, S.O. "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.
2. Rajendran V. "Engineering Physics". Tata McGraw Hill Publications, 2012.

REFERENCES

1. Garcia, N. & Damask, A. "Physics for Computer Science Students". Springer-Verlag, 2012.
2. Hanson, G.W. "Fundamentals of Nanoelectronics". Pearson Education, 2009.

E-RESOURCES

1. https://nptel.ac.in/downloads/122101002/ (Introduction to Materials)
2. https://swayam.gov.in/nd1_noc19_ph14/preview (Solid State Physics)

19GET203	BASIC CIVIL AND MECHANICAL ENGINEERING (Common to CSE, ECE and EEE Branches)	L T P C 3 0 0 3

OBJECTIVES

To enable the students to:

- Familiarize the materials and measurements used in Civil Engineering.
- Provide the exposure on the fundamental elements of civil engineering structures.
- Enable the students to distinguish the components and working principle of power plant and pumps.
- Enable the students to distinguish the components and working principle of IC engines and various sources of energy.
- Understand refrigeration and air condition system, manufacturing and fabrication techniques.

UNIT I: CIVIL ENGINEERING MATERIALS AND SURVEYING **9**

Role of civil engineering for the welfare of Society - Introduction- Bricks - stones - sand - cement - concrete - Necessity of special Concrete- steel -timber - modern materials- Surveying : Objects - Classification - Principles - Measurement of Distances - Angles - Levelling - Determination of Areas - Contours - Examples.

UNIT II: BUILDING COMPONENTS AND STRUCTURES **9**

Foundations: Soil-General types of soil -Types of foundations - Bearing capacity and settlement Factors affecting bearing capacity- Requirement of good foundations- causes of failure of foundations. Civil Engineering Structures: Super structure:Brick masonry - stone masonry - beams - columns - lintels - roofing - flooring - plastering - Types of Bridges and Dams - floor area, carpet area - Classification and purposes governing selection of site - Water supply - sources and quality of water - Rain water harvesting.

UNITIII: POWER PLANT ENGINEERING **9**

Introduction, Classification of Power Plants - Working principle of steam, Gas, Diesel, Hydro -electric and Nuclear Power plants - Merits and Demerits.Pumps - working principle of Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps, Turbines - working principle of Impulse and reaction turbine.

UNIT IV: IC ENGINES AND ALTERNATE SOURCES OF ENERGY **9**

Internal combustion engines - Working principle of Petrol and Diesel Engines - Four stroke and two stroke cycles - Comparison of four stroke and two stroke engines - Automobile -

important components and its functions. Alternate Energy sources - Solar energy, Wind energy, Tidal and Geothermal energy.

UNIT V: AIR CONDITIONING AND MANUFACTURING TECHNOLOGY 9

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression - Layout of typical domestic refrigerator - Window and Split type room Air conditioner. Principle and applications of Metal forming process - Foundry, Forging and Metal joining process - Welding.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course, the students can:

- Know the various functions of Civil Engineer and to identify the suitable construction materials.
- Demonstrate the various elements of sub-structure and super-structure.
- Understand the basic concepts in thermal engineering and fluid mechanics.
- Display the IC engine working principles of various energy sources.
- Exhibit an understanding of principles and applications of mechanical power transmission components and basic manufacturing process.

TEXT BOOKS

1. K.Venugopal, V.Praburaja, G,.Sreekanjana "Basic Civil and Mechanical Engineering" Anuradha Publications, Chennai, 2001.
2. Shanmugam.G and Palanichamy.MS, "Basic Civil and Mechanical Engineering", Tata McGraw Hill PublishingCo.,NewDelhi, 2018.

REFERENCES

1. Dr.B.C.Punmic, Ashoke K.Jain, Arun K.Jain, "Basic Civil Engineering" Laxmi publications (P) LTD, New Delhi, 2008.
2. Shantha Kumar S R J., "Basic Mechanical Engineering", Hi-tech Publications, Mayil.

E-RESOURCES

1. https://nptel.ac.in/courses/105/102/105102088/ (Functions of Buildings)
2. https://nptel.ac.in/courses/112/107/112107291/- (Power plant Engineering)

19ECE201 **ELECTRONIC DEVICES** **L T P C**
(Lab Embedded Theory Course) **3 0 2 4**
(For ECE Branch)

OBJECTIVES

To enable students to **:**

- Acquaint the students with the construction, theory and operation of the PN junction diode, and obtain the VI Characteristics.
- Learn the operation and characteristics of Bipolar Transistor in different configurations.
- Know the construction and operation and characteristics of FET and its various types.
- Learn the characteristics of basic electronic devices having different doping and various kind of materials.
- Know about various power devices and display devices and its characteristics and applications.
- Perform the various experiments using Electronic devices.

UNIT I: SEMICONDUCTOR DIODE **9**

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.

UNIT II: BIPOLAR JUNCTION TRANSISTORS **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 III: FIELD EFFECT TRANSISTORS **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.

UNIT IV: SPECIAL SEMICONDUCTOR DEVICES **9**

Metal-Semiconductor Junction- MESFET, FINFET, PINFET, CNTFET, DUAL GATE

MOSFET, Schottky barrier diode-Zener diode-Varactor diode - Tunnel diode- Gallium Arsenide device, LASER diode, LDR.

UNIT V: POWER DEVICES AND DISPLAY DEVICES **9**

UJT, SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD

LIST OF EXPERIMENTS

(Any Ten Experiments to be conducted)

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 and SCR Characteristics
6. Clipper and Clamper & FWR
7. Verifications of Thevinin & Norton theorem
8. Verifications of KVL & KCL
9. Verifications of Super Position Theorem
10. Verifications of maximum power transfer & reciprocity theorem
11. Determination of Resonance Frequency of Series & Parallel RLC Circuits
12. Transient analysis of RL and RC circuits

TOTAL: 45+15=60 PERIODS

OUTCOMES:

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

- Explain the operation and V-I characteristic of diode , Bipolar and Field effect Transistors, and obtain their VI characteristics and different parameters.
- Develop the capacity to analyze electrical circuits, apply the circuit theorems in real time.
- Analyze the characteristics of basic electronic devices like BJT and FET.
- Describe the operation of special devices like Zener ,LASER diodes and power devices.
- Verify Thevenin & Norton theorem KVL & KCL, and Super Position Theorems.
- Have the exposure on the various experiments and characteristics using Electronic devices.

TEXT BOOKS

1. Donald A Neaman, Semiconductor Physics and Devices, 4th Edition, Tata Mc GrawHill Inc. 2012.
2. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, Electronic Devices and circuits, 3rd Edition, Tata McGraw- Hill, 2008.

REFERENCES

1. Robert Boylestad and Louis Nashelsky, Electron Devices and Circuit Theory Pearson Prentice Hall, 10th edition, July 2008.
2. R.S.Sedha, — A Text Book of Applied Electronics S.Chand Publications, 2006.

E-RESOURCES

1. https://nptel.ac.in/courses/117/107/117107095/ (Basic Electronics)
2. https://nptel.ac.in/courses/108/108/108108112/ (Semiconductor and Circuits)

19EEC201	HANDS ON TRAINING IN ELECTRICAL AND ELECTRONICS ENGINEERING (Employability Enhancement Course) (For EEE and ECE Branches)	L T P C 0 0 2 0

OBJECTIVES

To Enable the Students to:

- Gain practical experience on Electrical Appliances.
- Create awareness on non-conventional energy.

LIST OF EXPERIMENTS:

1. Maintenance of UPS and Battery.
2. Earthing of Power Devices.
3. Repair &Maintenance of Home Appliances.
4. Change of Fuse Links.
5. Repair &Maintenance of Air Compressor.
6. Repair &Maintenance of RO System (filter, pump moter).
7. Study of Electronic Devices.
8. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
9. Fluorescent lamp wiring.
10. Stair case wiring.
11. Soldering practice-components devices and circuits-using general purpose PCB.

TOTAL: 20 PERIODS

OUTCOMES

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

- Repair and service the electrical appliances.

SEMESTER III

19MAT301 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
(Common to CSE, ECE and EEE Branches) **3 1 0 4**

OBJECTIVES:

To enable the students to:

- Introduce the basic concepts of PDE for solving standard partial differential equations.
- Introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- Acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- Acquaint the student with Fourier transform techniques used in wide variety of situations.
- Introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I: PARTIAL DIFFERENTIAL EQUATIONS 9+3

Formation of partial differential equations - Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous types.

UNIT II: FOURIER SERIES 9+3

Dirichlet's conditions - General Fourier series - Odd and even functions - Half range Sine and Cosine series - Parseval's identity - Harmonic analysis.

UNIT III: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3

Classification of partial differential equations - Method of separation of variables - Fourier Series Solutions of one dimensional wave equation - One dimensional equation of heat conduction - Steady state solution of two dimensional equation of heat conduction.

UNIT IV: FOURIER TRANSFORMS 9+3

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

UNIT V: Z - TRANSFORMS AND DIFFERENCE EQUATIONS **9+3**

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

TOTAL: 45+15=60 PERIODS

OUTCOMES:

After successfully completing the course, the student will be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z- transform techniques for discrete time systems.

TEXT BOOKS

1. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. Narayanan S., ManicavachagomPillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 2012.

REFERENCES

1. N.P. Bali and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
2. Erwin Kreyszig, "Advanced Engineering Mathematics",10th Edition, John Wiley, India, 2016.

E - RESOURCES

1. https://nptel.ac.in/courses/111/105/111105035/ (Review Groups, Fields and Matrices)
2. https://nptel.ac.in/courses/111105035/27 (Complex Variables)

19ECT301 **SIGNALS AND SYSTEMS** **L T P C**
3 1 0 4

OBJECTIVES:

The student should be made to:

- Understand the basic properties of signal & systems.
- Know the methods of characterization of LTI systems in time domain.
- Analyze continuous time signals and system in the Fourier and Laplace domain.
- Analyze discrete time signals in the Fourier and Z transform domain.
- Analyze discrete time system in the Z transform domain.

UNIT I: CLASSIFICATION OF SIGNALS AND SYSTEMS **9+3**

Standardsignals-Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids,Classification of signals - Continuous time (CT) and Discrete Time (DT) signals, Periodic & A periodic 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 CONTINUOUSTIMESIGNALS **9+3**

Fourier series for periodic signals - Complex Fourier Series- Fourier Transform - properties- Laplace Transforms and properties.

UNIT III: LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS **9+3**

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNIT IV: ANALYSIS OF DISCRETETIME SIGNALS **9+3**

Baseband signal Sampling - Sampling theorem - Fourier Transform of discrete time signals (DTFT) - Properties of DTFT - Z Transform & Properties.

UNIT V: LINEAR TIME INVARIANT-DISCRETETIMESYSTEMS **9+3**

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+15 =60 PERIODS

OUTCOMES

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

- Determine if a given system is linear/causal/stable
- Capable of determining the frequency components present in a deterministic signal.
- Capable of characterizing LTI systems in the time domain and frequency domain.
- Compute the output of an LTI system in the time and frequency domains.
- Analyze the Recursive & Non-Recursive systems of Z Transform.

TEXT BOOKS

1. AllanV.Oppenheim,S.Wilsky and S.H.Nawab,—Signals and Systems‖, Pearson,2015
2. B.P. Lathi,—Principles of Linear Systems and Signals‖, 2nd Edition,Oxford,2009.

REFERENCES

1. R.E.Zeimer, W.H.Tranter and R.D.Fannin, —Signals &Systems - Continuous and Discrete‖, Pearson, 2007.
2. John Alan Stuller, —An Introduction to Signals and Systems‖,Thomson, 2007

E-RESOURCES

1. https://nptel.ac.in/courses/117/101/117101055 (Signals and Systems)
2. https://nptel.ac.in/courses/108/104/108104100/ (Principles Of Signals And System)

19EET304 **CIRCUIT THEORY** **L T P C**
3 1 0 4

OBJECTIVES

The student should be made to:

- Understand the basic concepts of DC and AC circuits behavior.
- Impart knowledge on solving circuit equations using network theorems.
- Introduce the phenomenon of resonance and coupled circuits.
- Educate on obtaining the transient response of circuits and analysis of two port networks.
- Familarize the network topologies.

UNIT I: BASIC CIRCUITS ANALYSIS **9+3**

Ohm's Law - Kirchoffs laws - DC and AC Circuits - Resistors in series and parallel circuits - Network reduction: voltage and current division - Source transformation - Star delta conversion - Mesh current and node voltage method of analysis for D.C and A.C. circuits.

UNIT II: NETWORK THEOREMS FOR DC AND AC CIRCUITS **9+3**

Network theorems : Superposition theorem - Thevenin's theorem - Norton's theorem - Reciprocity theorem - Millman's theorem - Maximum power transfer theorem - Application of Network theorems.

UNIT III: RESONANCE AND COUPLED CIRCUITS **9+3**

Series and parallel resonance - Frequency response - Quality factor and Bandwidth - Self and mutual inductance - Dot rule - Coefficient of coupling - Tuned circuits - Single tuned circuits.

UNIT IV: TRANSIENT RESPONSE ANALYSIS AND TWO PORT NETWORKS **9+3**

Natural response - Forced response - Transient response of RC, RL and RLC circuits to excitation by Step Signal, Impulse Signal and exponential sources - Two port networks - Z parameters - Y parameters - Hybrid(H) Parameters - Transmission (ABCD) parameters.

UNIT V: NETWORK TOPOLOGY **9+3**

Network terminology - Graph of a network - Tree - Co tree - Incidence and reduced incidencematrices - Cutsets - Fundamental cutsets - Cutset matrix - Tie sets - Link currents and Tie setschedules - Twig voltages and Cutset schedules - Duality and dual networks.

TOTAL : 45+15=60 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Understand and evaluate DC ad AC electrical circuits
- Develop the capacity to apply the circuit theorems in real time
- Acquire the knowledge about resonance and coupled circuits
- Analyze the concepts in transients and two port networks
- Design the network topologies

TEXT BOOKS

1. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, 'Engineering Circuit Analysis', McGraw Hill Science Engineering, Eighth Edition, 11th Reprint 2012.
2. Charles K. Alexander, Mathew N.O. Sadiku, 'Fundamentals of Electric Circuits', 6th, Tata McGraw Hill,2019.

REFERENCES

1. Chakrabati A, 'Circuits Theory (Analysis and synthesis)', Dhanpath Rai & Sons, NewDelhi, 2018.
2. Sudhakar A and Shyam Mohan SP, 'Circuits and Networks: Analysis and Synthesis', Tata McGraw Hill, 2015.

E-RESOURCES

1. www.nptel.in/courses/108/105/108105159/ (Network Analysis)
2. www.nptel.in/courses/117/106/117106108/ (Basic Electrical Circuits)

19ECE301 **DIGITAL ELECTRONICS** **L T P C**
(Lab Embedded Theory Course) **3 0 2 4**

OBJECTIVES

The student should be made to:

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

UNIT I: DIGITAL FUNDAMENTALS **9**

Number Systems - Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes - Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization and Quine-McCluskey method of minimization.

UNIT II: COMBINATIONAL CIRCUIT DESIGN **9**

and Full Adders, Half and Full Subtractors, Binary Design of Half Parallel Adder - Carry look ahead Adder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder, Verilog HDL for combinational circuits.

UNIT III: SYNCHRONOUS SEQUENTIAL CIRCUITS **9**

Flip flops - SR, JK, T, D, Master/Slave FF - operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits - Design - Moore/Mealy models, state minimization, state assignment, circuit implementation - Design of Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.

UNIT IV: ASYNCHRONOUS SEQUENTIAL CIRCUITS **9**

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Pulse mode sequential circuits, Design of Hazard free circuits, ASM chart.

UNIT V: MEMORY DEVICES AND DIGITAL INTEGRATED CIRCUITS **9**

Basic memory structure - ROM -PROM - EPROM - EEPROM - EAPROM, RAM - Static and dynamic RAM -Programmable Logic Devices - Programmable Logic Array (PLA)

Programmable Array Logic (PAL) - Field Programmable Gate Arrays (FPGA) - Implementation of combinational logic circuits using PLA, PAL.

LIST OF EXPERIMENTS

1. Verification of Boolean theorems using digital logic gates.
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters, etc.
3. Design and implementation of 4-bit binary adder / subtractor using basic gates and MSI devices.
4. Design and implementation of parity generator / checker using basic gates and MSI devices.
5. Design and implementation of magnitude comparator.
6. Design and implementation of application using multiplexers/ Demultiplexers.
7. Design and implementation of Shift registers.
8. Design and implementation of Synchronous and Asynchronous counters.
9. Simulation of combinational circuits and sequential circuits using Hardware Description Language (VHDL/Verilog HDL software required)
10. Design and implementation of a simple digital system (Mini Project).

TOTAL: 45+15=60 PERIODS

OUTCOMES

Students will be able to:

- Analyze different methods used for simplification of Boolean expressions.
- Design and implement Combinational circuits.
- Design and implement synchronous and asynchronous sequential circuits.
- Write simple HDL codes for the circuits.
- Use the semiconductor memories and related technology.

TEXT BOOK

1. M. Morris R. Mano, Michael D. Ciletti, —Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog‖, 6th Edition, Pearson Education, 2017.
2. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011

REFERENCE

1. G. K. Kharate, Digital Electronics, Oxford University Press, 2010.
2. John F. Wakerly, Digital Design Principles and Practices, 5th Edition, Pearson Education,2017.

E-RESOURCES

1. https://nptel.ac.in/courses/117/106/117106086/ (Digital Circuits And Systems)
2. https://nptel.ac.in/courses/108/105/108105132/ (Digital Electronic Circuits)

19ECE302	ELECTRONIC CIRCUITS (Lab Embedded Theory Course)	L T P C 3 0 2 4

OBJECTIVES

The student should be made to:

- Understand the operation, design and Analysis of low and high frequency amplifiers.
- Apply the knowledge of BJTs and MOSFETs to design practical electronic circuits.
- Analyze the frequency response of small signal amplifiers.
- Study about feedback amplifiers and oscillators principles
- Design oscillators and study about turned amplifier.

UNIT I: BIASING AND SMALL SIGNAL ANALYSIS OF AMPLIFIERS 9

DC Load line, Operating point, Various Biasing Methods for BJT-Design and Stability factors, Bias Compensation, Thermal Stability, Small signal Analysis of Common Emitter amplifiers. Cascaded stages - Cascode Amplifier.

UNIT II: MOS FIELD EFFECT TRANSISTORS 9

Device structure and physical operation, current voltage characteristics, MOSFET circuits at dc, Biasing in discrete MOS amplifier circuits, small signal operation and models, channel length modulation, transconductance, MOSFET as an amplifier - CS stage, CS stage with degeneration, CG and CD stages, discrete amplifier design problems.

UNIT III: FREQUENCY RESPONSE OF AMPLIFIERS 9

Amplifier frequency response - Frequency response of transistor amplifiers with circuit capacitors - BJT frequency response - short circuit current gain - cut off frequency - fα, fβ andunity gain bandwidth - Miller effect - frequency response of FET - High frequency analysis of CE and MOSFET CS amplifier - Transistor Switching Times.

UNIT IV: FEEDBACK AMPLIFIERS AND STABILITY 9

Feedback Concepts - gain with feedback - effect of feedback on gain stability, distortion, bandwidth, input and output impedances; topologies of feedback amplifiers - analysis of series- series, shunt-shunt and shunt-series feedback amplifiers-stability problem-Gain and Phase- margins-Frequency compensation.

UNIT V: OSCILLATORS AND TUNED AMPLIFIERS 9

Barkhausen criterion for oscillation - phase shift, Wien bridge - Hartley & Colpitt's oscillators - Clapp oscillator - oscillator amplitude stabilization-Small signal tuned amplifiers - Analysis of capacitor coupled single tuned amplifier-Stagger tuned amplifiers.

LIST OF EXPERIMENTS

1. Design of Regulated Power supplies.
2. Frequency Response of CE, CB, CC and CS amplifiers.
3. Darlington Amplifier.
4. Differential Amplifiers - Transfer characteristics, CMRR Measurement.
5. Determination of bandwidth of single stage and multistage amplifiers.
6. Series and Shunt feedback amplifiers-Frequency response, Input and output impedance.
7. RC Phase shift oscillator / Wien Bridge Oscillator.
8. Hartley Oscillator / Colpitts Oscillator.

SIMULATION USING SPICE

1. Analysis of BJT with Fixed bias and Voltage divider bias using Spice.
2. Analysis of FET, MOSFET with fixed bias, self-bias and voltage divider bias using simulation software like Spice.
3. Wein Bridge Oscillator.
4. Bistable Multivibrator

TOTAL: 45 +15=60 PERIODS

OUTCOMES

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

- Apply the knowledge of BJT to design practical amplifier circuits.
- Analyse discrete analog circuits based on BJTs, MOSFETS and Op-amps.
- Frequency response characteristics of BJT and FET amplifiers.
- Analyze different types of amplifier, and oscillator circuits.
- Design BJT amplifier and oscillator circuits.

TEXT BOOKS

1. Donald. A. Neamen, Electronic Circuits Analysis and Design, 3rd Edition, Mc Graw Hill Education (India) Private Ltd., 2010.
2. Jacob Millman, 'Microelectronics', McGraw Hill, 2nd Edition, Reprinted, 2009.

REFERENCES

1. Millman J, Halkias.C.and Sathyabrada Jit, Electronic Devices and Circuits, 4th Edition,Mc Graw Hill Education (India) Private Ltd., 2015.
2. Salivahanan and N. Suresh Kumar, Electronic Devices and Circuits, 4th Edition, , Mc Graw Hill Education (India) Private Ltd., 2017.

E-RESOURCES

1. https://nptel.ac.in/courses/108/105/108105158/ (Analog Electronic Circuits)
2. https://nptel.ac.in/courses/117/106/117106088/ (Electronics For Signal Processing)

19CSE303	DATA STRUCTURES USING C (Lab Embedded Theory Course)	L T P C 3 0 2 4

OBJECTIVES:

The student should be made to:

- Learn the features of C .
- Learn the linear and non-linear data structures.
- Explore the applications of linear and non-linear data structures.
- Learn to represent data using graph data structure.
- Learn the basic sorting and searching algorithms.

UNIT I: C PROGRAMMING BASICS **9**

Structure of a C program - Constants, Variables - Data Types - Expressions using operators in C - Managing Input and Output operations - Decision Making and Branching - Looping statements. Arrays - Strings- String operations. Simple programs - sorting- searching – matrix operations.

UNIT II: FUNCTIONS, POINTERS, STRUCTURES AND UNIONS **9**

Functions - Pass by value - Pass by reference - Recursion - Pointers - Definition - Initialization - Pointers arithmetic. Structures and unions - Structure within a structure and Unions - Storage classes, Pre-processor directives.

UNIT III: LINEAR DATA STRUCTURES **9**

Arrays and its representations - Stacks and Queues - Linked lists - Linked list-based implementation of Stacks and Queues and its operations(Insert, Traverse and Delete) - Evaluation of Expressions - Linked list based polynomial addition.

UNIT IV: NON-LINEAR DATA STRUCTURES **9**

Trees - Binary Trees - Binary tree representation and traversals - Binary Search Trees and its operations - Applications of trees. Set representations - Union-Find operations. Graph and itsrepresentations - Graph Traversals Techniques.

UNIT V: SEARCHING AND SORTING ALGORITHMS **9**

Linear Search - Binary Search. Bubble Sort, Insertion sort - Merge sort - Quick sort - HeapSort -Hash tables - Overflow handling.

LIST OF EXPERIMENTS

1. Basic C Programs - looping, data manipulations and arrays.
2. Programs using strings - String function implementation.
3. Programs using structures and pointers.
4. Programs involving dynamic memory allocations.
5. Array implementation of stacks and queues.
6. Linked list implementation of stacks and queues.
7. Application of stacks and queues.
8. Implementation of Trees, Tree Traversals.
9. Implementation of Binary Search trees.
10. Implementation of Linear search and binary search.
11. Implementation Insertion sort, Bubble sort, Quick sort and Merge Sort.
12. Implementation Hash functions, collision resolution technique.

TOTAL: 45 +15=60 PERIODS

OUTCOMES:

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

- Implement linear and non-linear data structure operations using C.
- Suggest appropriate linear / non-linear data structure for any given data set.
- Apply hashing concepts for a given problem.
- Modify or suggest new data structure for an application.
- Appropriately choose the sorting algorithm for an application.

TEXT BOOKS:

1. Pradip Dey and Manas Ghosh, —Programming in C, 2nd Edition, Oxford University Press, 2015.
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, 2nd, University Press, 2017.

REFERENCES:

1. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 1996.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structuresand Algorithms, Pearson Education, 1983.

E-RESOURCES

1. https://nptel.ac.in/courses/106/104/106104128/ (Introduction to Programming in C)
2. https://nptel.ac.in/courses/106/105/106105164/ (Introduction to Algorithms and Analysis)

19EEC301 **COMMUNICATION SKILLS** **L T P C**
0 0 2 0

OBJECTIVES:

The purpose of learning this course is to:

- Improve fluency in English through well developed vocabulary.
- Improve the oral communication skills.
- Focus the effective reading of general and technical text.
- Improve writing skill.
- Communicate ideas in group discussion and interviews.

Unit I: VOCABULARY 6

Vocabulary building - articulate ideas and thoughts; usage of palindromes,greetings, wishes, festival related words - homophones and homonyms- connotation - vocabulary words with sentences. - Idiomatic Expressions - One- word Substitutes.

Activities: Learn a word a week, Use newspaper to write unfamiliar words, Word association games.

Unit II: LISTENING 6

Listening Skill- Its importance - Purpose- Process- Types- Barriers- Effective Listening strategies- Listening and note-taking - Listening to telephonic conversations - Ted talks - Watching Inspiring Speech videos on You tube- Listening native speaker's videos for pronunciation.

Activities: Listen and draw the different scenes in a story, Secret Message games,watching videos and listing difficult words.

UNIT III: SPEAKING 6

JAM Talk - Role play - Debate - Conversational skills (formal and informal) - Conversation practice - group discussion and interview skills - Introducing oneself and others - - Presentation skills -Making presentations (individual and group) through seminars / PPTs.

Activities: Picture Description, Giving Directions and Guidelines, Making a short speech-Extempore.

UNIT IV: READING 6

Strategies for effective reading (Guessing meanings from contexts -Scanning, skimming, inferring meaning and critical reading)- Read and recognize different text types ranging from

newspaper articles, magazines, books, Technical articles and Reading autobiographies -.

Activities: Reading online sources like e-books, e-journals and e-newspapers, cloze exercises, Reading and answering questions.

UNIT V: WRITING 6

Develop a paragraph: topic sentence, supporting sentences, concluding sentence - Writing simple Essays - argument, descriptive and comparative essays- Creative writing.

Activities: Write Essays with sub titles,Write a story that uses as many clichés and idioms, Write Paragraph.

TOTAL : 30 PERIODS

The following Practice Session will be conducted for the Communication Skills (CS) Lab sessions:

- Activities on Presentations Skills- Students make presentations on given topics.
- Activities on Group Discussion- Students participate in group discussions.
- Interview Skills- Students participate in Mock Interviews.
- EssayWriting - Students prepare their own paragraph and essay.

Guidelines for conducting assessments as per 2019 regulations

- 30 hours - Two consecutive hours allotted for each class.
- Three Continuous assessments only conducted and no end semester exam.
- For the award of Continuous assessment the best three activities from Essay Writing, Oral Presentation, Extempore,Group Discussion and Mock Interview(one-on-one basis)can be taken.

OUTCOMES:

At the end of this course, learners will be able to:

- Improve vocabulary and express the same contextually.
- Communicate to his peer group properly and make presentations.
- Comprehend the general and technical text.
- Write simple paragraph and essay in any topic.
- Participate in group discussions expressing ideas relevantly, coherently and cogently.

TEXT BOOKS:

1. Gramer F. Margot and Colin S. Ward Reading and Writing (Level 3) Oxford University .Press:Oxford, 2011.

2. Brooks,Margret. Skills for Success. Listening and Speaking. Level 4 Oxford UniversityPress, Oxford: 2011.

REFERENCES:

1. Davis, Jason and Rhonda LIss. Effective Academic Writing (Level 3) Oxford University Press: Oxford, 2006.
2. E. Suresh Kumar and et al. Enriching Speaking and Writing Skills. 2nd Edition. Orient Black swan.
3. Anderson, Kenneth et al. Study Speaking: A Course in Spoken English for Academic Purposes. United Kingdom: Cambridge University Press 1992.
4. Technical communication by Asraf rezvi.

E- RESOURCES :

1. www.youglish.com
2. www.Newwellington University.com
3. www.newsinlevels.com
4. www.Britishcouncil.org
5. www.writeandimprove.com
6. www.purdueonline.com

19MDC301	LEADERSHIP ENHANCEMENT PROGRAMME (Common to all branches)	L T P C 1 0 0 0

OBJECTIVES

The objective of the course is enabling the students to:

- Find new, innovative ways of developing and managing people.
- Develop new business opportunities.
- Tackle the broader societal issues the face.
- Key benefits of leadership skills in different situations.
- Formulate and implement effective leadership strategies.

TOIPICS TO BE COVERED

1. Leadership for an Engineering students: Skills & Strategies
2. Qualities of good leaders and 21 irrefutable laws of Leadership.
3. Empowering Others and Managing People.
4. Leading Meetings
5. Leadership competencies and Leadership Styles
6. Difference between a boss and a leader.
7. Leadership and Assertiveness Skills: A Good Leader, Leadership Theories, Leadership Behaviour, Assertiveness skills.
8. Leadership development opportunities and suggestions.
9. Teamwork and Leadership: Concept of teams, Building Effective teams, Concept of leadership and sharpening leadership skills.
10. Teamwork and Leadership Activities: Group discussion, Solving Puzzle as a team, describing a leadership style.

OUTCOMES

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

- Develop the capabilities needed to increase team's work productivity.
- Help to decrease employee turnover and increase engagement, creating a strong and united team.
- Develop communication skills, mastering the art of negotiation, influence and conflict management.
- More confident as a leader and find new ways of influencing the teams they lead.

- Effectively connect to people, developing the ability to give constructive feedback, and critically seek the feedback of the team.

TOTAL: 12 PERIODS

TEXT BOOK

1. John maxwell, "21 irrefutable laws of leadership" 2008
2. Sara n. King, David g. Altman, Robert j. Lee, "Discovering the leader in you"
3. Louis carter ,David ulrich , Marshall Goldsmith "Best practices in leadership development and Organization change".

REFERENCE

1. Barry Benator, Albert Thumann,"Project Management and Leadership Skills for Engineering and Construction Projects" 2003.
2. Sydänmaanlakka Pentti. "Intelligent leadership and leadership competencies". Dissertation Series.

E-RESOURCES

1. https://nptel.ac.in/courses/122/105/122105021/
2. www.ccl.org/leadership/research/index.aspx.

SEMESTER IV

19MAT402 PROBABILITY AND RANDOM PROCESSES L P T C
3 1 0 4

OBJECTIVES

The student should be made to:

- Provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- Understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- Understand the basic concepts of random processes which are widely used in IT fields.
- Understand the concept of correlation and spectral densities.
- Understand the significance of linear systems with random inputs.

UNIT I: PROBABILITY AND RANDOM VARIABLES 9+3

Probability - Axioms of probability - Discrete and continuous random variables - Moments - Moment generating functions - Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II: TWO - DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions - Marginal and conditional distributions - Covariance - Correlation and linear regression - Transformation of random variables - Central limit theorem (for independent andidentically distributed random variables).

UNIT III: RANDOM PROCESSES 9+3

Classification - Stationary process - Markov process - Markov chain - Poisson process - Random telegraph process.

UNIT IV: CORRELATION AND SPECTRAL DENSITIES 9+3

Auto correlation functions - Cross correlation functions - Properties - Power spe ctral density - Cross spectral density - Properties.

UNIT V: LINEAR SYSTEMS WITH RANDOM INPUTS 9+3

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

TOTAL: 45+15=60 PERIODS

OUTCOMES

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and applyin engineering applications.
- Apply the concept random processes in engineering disciplines.
- Understand and apply the concept of correlation and spectral densities.
- The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable. Able to analyze the response of random inputs to linear time invariant systems.

TEXT BOOKS

1. Ibe, O.C., "Fundamentals of Applied Probability and Random Processes", 1st Indian Reprint,Elsevier, 2007.
2. Peebles,P.Z.,"Probability,Random Variables and Random Signal Principles", Tata McGrawHill, 4th Edition, New Delhi, 2002

REFERENCES

1. Cooper. G.R., McGillem. C.D., "Probabilistic Methods of Signal and System Analysis", Oxford University Press, New Delhi, 3rd Indian Edition, 2012.
2. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes ", Tata McGraw Hill Edition, New Delhi, 2004.

E-RESOURCES

1. https://nptel.ac.in/courses/117/105/117105085/ (Probability and Random Processes)
2. https://nptel.ac.in/courses/111/106/111106053/ (Review of Set Theory)

19ECT401 **ELECTROMAGNETIC FIELDS** **L T P C**
3 1 0 4

OBJECTIVES

To enable students to:

- Gain conceptual and basic mathematical understanding of electric and magnetic fields in free space and in materials.
- Understand the coupling between electric and magnetic fields through faraday's law, displacement current and maxwell's equations.
- Understand wave propagation in lossless and in lossy medium.
- Solve problems based on the above concepts.
- Study the plane waves in various mediums.

UNIT I: VECTOR ALGEBRA **9+3**

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

UNIT II: ELECTROSTATICS **9+3**

Electric field, Coulomb's law, Gauss's law and applications, Electric potential, Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Capacitance, Parallel, cylindrical and spherical capacitors, Electrostatic energy, Poisson's and Laplace's equations, Uniqueness of electrostatic solutions, Current density and Ohm's law, Electromotive force and Kirchhoff's voltage law, Equation of continuity and Kirchhoff's current law.

UNIT III: MAGNETOSTATICS **9+3**

Lorentz force equation, Law of no magnetic monopoles, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Magnetic circuits, Behaviour of magnetic materials, Boundary conditions, Inductance and inductors, Magnetic energy, Magnetic forces and torques.

UNIT IV: TIME-VARYING FIELDS AND MAXWELL's EQUATIONS **9+3**

Faraday's law, Displacement current and Maxwell-Ampere law, Maxwell's equations, Potential functions, Electromagnetic boundary conditions, Wave equations and solutions, Time-harmonic fields.

UNIT V: PLANE ELECTROMAGNETIC WAVES 9+3

Plane waves in lossless media, Plane waves in lossy media (low-loss dielectrics and good conductors), Group velocity, Electromagnetic power flow and Poynting vector, Normal incidence at a plane conducting boundary, Normal incidence at a plane dielectric boundary.

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Display an understanding of fundamental electromagnetic laws and concepts.
- Write Maxwell's equations in integral, differential and phasor forms and explain their physical meaning.
- Explain electromagnetic wave propagation in lossy and in lossless media.
- Solve simple problems requiring estimation of electric and magnetic field quantities based on these concepts and laws**.**
- Analyze the relation between the fields under time varying situations.

TEXT BOOKS

1. D.K. Cheng, Field and wave electromagnetics, 2nd ed., Pearson (India), 1989.
2. W.H. Hayt and J.A. Buck, Engineering electrmagnetics, 7th ed., McGraw-Hill (India), 2006.

REFERENCES

1. D.J. Griffiths, Introduction to electrodynamics, 4th ed., Pearson (India),2013.
2. B.M. Notaros, Electromagnetics, Pearson: New Jersey,2011.
3. M.N.O. Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th ed., Oxford (AsianEdition),2015.

E-RESOURCES

1. https://nptel.ac.in/courses/108/106/108106073/ (Electromagnetic Fields)
2. https://nptel.ac.in/courses/117/103/117103065/(Electromagnetic Fields)

19ECT402 MEASUREMENTS AND INSTRUMENTATION L T P C
3 0 0 3

OBJECTIVES

The student should be made to:

- Understand general instrument system, error, calibration etc.
- Know the various operating principle of instruments which use to AC and DC measurements.
- Elaborate discussion about storage & display devices.
- Impart knowledge on various bridges.
- Create an exposure for various transducers.

UNIT I: BASICS OF MEASUREMENTS AND INSTRUMENTS 9

Functional elements of an instrument - static and dynamic characteristics -errors in measurements - statistical evaluation of measurement data -direct and indirect measurement methods -classification of instruments - standards and calibration.

UNIT II: ANALOG METERS 9

Analog ammeters and voltmeters: Permanent Magnet Moving Coil instrument (PMMC), Moving Iron instruments, electro dynamic instruments -Instrument transformer: current transformer, potential transformer - measurement of power - Electro dynamo meter type - frequency meters - synchroscope.

UNIT III: DIGITAL METERS AND STORAGE, DISPLAY DEVICES 9

Digital voltmeters -digital frequency meter - printers and plotters - cathode ray oscilloscopes - CRT circuits and screens -electrostatic deflection -digital storage oscilloscope -digital LED, LCD and dot matrix display.

UNIT IV: BRIDGES 9

Measurement of resistance - Wheatstone bridge, Kelvin's bridge -Measurement of self inductance - Maxwell, Hay's, Owen's bridges - measurement of capacitance - Schering Bridge - Frequency measurement using Wien Bridge.

UNIT V: TRANSDUCERS 9

Classification of transducers - selection of transducers - resistive transducers - strain gauge, bounded, unbounded and semiconductor gauges, resistance thermometers, thermistors -

Inductive transducers - LVDT, RVDT-capacitive transducers – piezo electric transducers -digital transducers.

TOTAL: 45 PERIODS

OUTCOMES

The students can:

- Analyze the performance characteristics of an instrument, standards and calibration.
- Understand DC and AC measuring instruments.
- Discriminate the functions of various storage and display devices.
- Measuring the R, L, and C using bridges.
- Measure electrical and non electrical quantities by transducers.

TEXT BOOKS

1. Sawhney,A.K., A Course in Electrical & Electronic Measurements& instrumentation, Dhanpat Rai and Co, 2014.
2. Albert D.Helfrick.William D.Cooper Modern Electronic Instrumentation &measurement techniques, Prentice Hall of India 2003.

REFERENCES

1. Kalsi, H.S., Electronic Instrumentation, Tata McGraw Hill, 2012.
2. Doebelin, E.O., Measurement Systems - Application and Design, Tata McGraw Hill publishing company, 2005.
3. R.K Rajput, Electrical Measurements and Measuring Instruments, S.Chand & Company LTD, 2009.

E - RESOURCES

1. https://nptel.ac.in/courses/108/105/108105153/ (Electrical Measurements and Electronic Instrument)
2. https://nptel.ac.in/courses/108/108/108108147/ (Sensors And Actuators)

19EET403 **CONTROL SYSTEMS ENGINEERING** **L T P C**
3 1 0 4

OBJECTIVES

The student should be made to:

- Provide the fundamental concepts of Control systems and mathematical modelling of the system.
- Teach the concept of time response and frequency response of the system.
- Knowledge in stability analysis of control systems.
- Understand and differentiate the basics of linear time-invariant control system.
- Learn Concepts of state variables and state model, derivation of state models.

UNIT I: INTRODUCTION **9+3**

Concepts of Control Systems - Open Loop and closed loop control systems and their differences -Different examples of control systems - Classification of control systems, Feedback Characteristics,Mathematical models - Mechanical Translational and Rotational systems- Transfer Function Representation: - Block diagram algebra - Representation by Signal flow graph - Reduction using Mason's gain formula.

UNIT II: TIME RESPONSE ANALYSIS **9+3**

Standard test signals - Time response of first order systems - Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications - Steady state response - Steady state errors and error constants - Effectsof proportional derivative, proportional integral systems.

UNIT III: FREQUENCY RESPONSE ANALYSIS **9+3**

Introduction, Frequency domain specifications - Bode diagrams - Determination of frequency domain specifications and Phase margin and Gain margin - Stability analysis from Bode Plots - Polar Plots - Nyquist Plots. Compensation Techniques: Lag, Lead and Lead-Lag Controllers design in frequency response.

UNIT IV: STABILITY ANALYSIS IN S-DOMAIN **9+3**

The concept of stability - Routh's stability criterion - Qualitative stability and conditional stability - Limitations of Routh's stability-Root Locus Technique:The root locus concept - Construction of root loci-Effects of adding poles and zeros to G(s) H(s) on the root loci.

UNIT V: STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS 9+3

Concepts of state, state variables and state model, derivation of state models from block diagrams - Solving the Time invariant state equations - State Transition Matrix and it'sProperties - Concepts of Controllability and observability.

TOTAL: 45+15=60 PERIODS

OUTCOMES

Upon Completion of the course, the students will be abile to:

- Apply transfer function models to analyze physical systems.
- Determine the transient and steady state behavior of systems subjected to standardtest signals.
- Analyze the linear systems for absolute and relative stability in time and frequency domain.
- Analyze the stability of the linear system in frequency domain and design compensators.
- Familiarize with state space analysis and system properties like Controllability and Observability.

TEXT BOOKS

1. J.Nagrath and M.Gopal, "Control Systems Engineering", 6th Edition, New Age International (P) Ltd,Publishers, 2017.
2. K.Ogata, "Modern Control Engineering", 4 thEdition, Prentice Hall, 2003.

REFERENCES

1. A.Nagoor kani, "Control Systems", RBA Publications, 2nd Edition, 2006.
2. M.Gopal, "Control System: Principles and Design", Tata McGraw Hill, 2 nd Edition, 2002

E - RESOURCES

1. https://nptel.ac.in/courses/108/106/108106098/ (Control Engineering)
2. http://nptel.ac.in/courses/108101037/(Control Engineering)

19ECE401	COMMUNICATION THEORY (Lab Embedded Theory Course)	L T P C 3 0 2 4

OBJECTIVES

The student should be made to:

- Introduce the concepts of various analog modulations and spectralcharacteristics.
- Learn the concept of angle modulation.
- Know the effect of noise communication systems.
- Know the principles of sampling and quantization.
- Study the limits set by information Theory.

UNIT I: AMPLITUDE MODULATION **9**

Amplitude Modulation- DSBSC, DSBFC, SSB, VSB - Modulation index, Spectra, Power relations and Bandwidth - 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, Super heterodyne Receiver .

UNIT II: ANGLE MODULATION **9**

Frequency Modulation: Narrow band Frequency modulation, wide band FM, transmission band width of FM waves, generation of FM waves: Indirect FM and direct FM. Demodulation of FM waves, FM stereo multiplexing, Phase-locked loop.

UNIT III: 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, Envelope and Phase - Noise performance analysis in AM & FM systems - Threshold effect, Pre-emphasis and de-emphasis for FM.

UNIT IV: SAMPLING THEORY **9**

Low pass sampling, Quadrature sampling, Signal Reconstruction, Signal distortion in sampling, Practical Aspects of Sampling and Signal Recovery, Pulse Amplitude Modulation, Pulse width Modulation and Pulse Position Modulation.

UNIT V: INFORMATION THEORY AND CODING **9**

Amount of Information - Entropy - Information Rate - Source Coding to Increase Average Information Per Bit - Shannon-Fano Coding - Huffman Coding - BEC - BSC – Shannon's Theorem - Channel Capacity - Bandwidth - SNR Trade-Off - Mutual Information.

LIST OF EXPERIMENTS

1. Signal Sampling and reconstruction.
2. AM Modulator and Demodulator.
3. Time Division Multiplexing.
4. FM Modulator and Demodulator.
5. Pulse Code Modulation and Demodulation.
6. Delta Modulation and Demodulation.
7. Observation (simulation) of signal constellations of QPSK.
8. FSK, PSK schemes (Simulation).

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Design AM communication systems.
- Design Angle modulated communication systems.
- Apply the concepts of Random Process to the design of Communication systems.
- Analyze the noise performance of AM and FM systems.
- Gain knowledge in sampling and quantization.

TEXT BOOKS

1. J.G.Proakis, M.Salehi, —Fundamentals of Communication Systems‖, Pearson Education 2014.
2. Simon Haykin, —Communication Systems‖, 4th Edition, Wiley, 2014.

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. B.Sklar, —Digital Communications Fundamentals and Applications‖, 2nd Edition Pearson Education 2007.

E-RESOURCES

- https://nptel.ac.in/courses/108/102/108102117/ (Information Theory, Coding and cryptography)
- https://nptel.ac.in/courses/117/102/117102059/ (Communication Engineering)

19ECE402	LINEAR INTEGRATED CIRCUITS (Lab Embedded Theory Course)	L T P C 3 0 2 4

OBJECTIVES

The main objective of this course is to:

- Introduce the basic building blocks of linear integrated circuits.
- Learn the linear and non-linear applications of operational amplifiers.
- Introduce the theory and applications of analog multipliers and PLL.
- Learn the theory of ADC and DAC.
- Introduce the concepts of waveform generation and introduce some special function ICs.

UNIT I: OPERATIONAL AMPLIFIER FUNDAMENTALS **9**

Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, 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 - JFET 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, Low-pass, high-pass and band-pass Butterworth filters.

UNIT III: ANALOG MULTIPLIER AND PLL **9**

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell - Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator, Monolithic PLL IC 565, Applications of PLL.

UNIT IV: ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS **9**

Performance Specifications - D-A Conversion Techniques - Weighted Resistor DACs - R-2RLadders - Current Mode R-2R Ladder - Voltage Mode R-2R Ladder - Multiplying DAC Applications - A-D Conversion Techniques - Successive Approximation Converters - Flash Converters - Integrating Type Converters - Over Sampling Converters.

UNIT V: WAVEFORM GENERATORS AND VOLTAGE REGULATORS 9

Sine-wave generators, Multivibrators and Triangular wave generator, Saw-tooth wave generator, ICL8038 function generator, Timer IC 555, IC Voltage regulators - Three terminal fixed and adjustable voltage regulators - IC 723 general purpose regulator - Monolithic switchingregulator, Low Drop - Out(LDO) Regulators

LIST OF EXPERIMENTS

1. Inverting, Non inverting and differential amplifiers.
2. Design of Integrator and Differentiator using Op-amp.
3. Design of Differential amplifier to find CMRR using Op-amp.
4. Design of Instrumentation amplifier.
5. Design of Low pass and High pass filters using Op-amp.
6. Design of Astable and Monostable multivibrator using Op-amp.
7. Design of Schmitt trigger using Op-amp.
8. Phase shift and Wien bridge oscillators using Op-amp.
9. Design of Monostable and Astable multivibrators using IC 555.
10. DC power supply using LM317 and LM723.
11. Simulation of Active low-pass, High-pass and band-pass filters using Op-amp
12. Simulation of Analog Multiplier.

TOTAL : 45+15=60 PERIODS

OUTCOMES

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

- Design linear and non linear applications of OP - AMPS.
- Incorporate applications using analog multiplier and PLL.
- Construct ADC and DAC using OP - AMPS.
- Generate waveforms using OP - AMP Circuits.

TEXT BOOKS

1. D.Roy Choudhry, Shail Jain, —Linear Integrated Circuits‖, New Age International Pvt. Ltd., 2018, 5th Edition.
2. Sergio Franco, —Design with Operational Amplifiers and Analog Integrated Circuits‖, 4th Edition, Tata Mc Graw-Hill, 2016.

REFERENCES

1. Ramakant A. Gayakwad, —OP-AMP and Linear ICs‖, 4th Edition, Prentice Hall /Pearson Education, 2015.
2. Robert F.Coughlin, Frederick F.Driscoll, —Operational Amplifiers and Linear Integrated Circuits‖, 6th Edition, PHI, 2001.

E-RESOURCES

1. https://nptel.ac.in/courses/108/108/108108111/ (Integrated Circuits, MOSFETS OP-AMPS and their Applications ,)
2. https://nptel.ac.in/courses/117/106/117106030/(Analog IC Design)

19EEC302	ENTREPRENEURSHIP DEVELOPMENT ACTIVITY (Common to all Branches)	L T P C 0 0 2 0

OBJECTIVES

The course objectives can make students to:

- Evaluate social and civil responsibilities of business ownership.
- Describe typical behavioral characteristics of an effective entrepreneur.
- Develop a business plan, including identifying an executive summary; conducting a marketing and competitive analysis report; and developing a marketing, management, and financial plan.
- Determine career opportunities, responsibilities, and educational and credentialing requirements related to various entrepreneurship ventures.
- Interpret research data to determine market-driven problems faced by entrepreneurs.

TOIPICS TO BE COVERED

1. Should You Become an Entrepreneur?
   - Entrepreneurship: Present & Past
   - Is Entrepreneurship Right for You
   - Identify Business Opportunities & Set Goals
2. What Skills Do Entrepreneurs Need
   - Communication Skills
   - Math Skills
   - Problem Solving Skills
3. Entrepreneurs in a Market Economy
   - What is an Economy?
   - The Concept of Cost
   - Government in a Market Economy
4. Select a Type of Ownership
   - Run an Existing Business

- Own a Franchise or Start a Business
- Choose the Legal Form of Your Business

5. Develop a Business Plan
   - Why Do You Need a Business Plan
   - What Goes into a Business Plan
   - Create an Effective Business Plan
6. Identify and Meet a Market Need
   - The Value of Market Research
   - How to Perform Market Research Entrepreneurship Syllabus
   - Identify Your Competition
7. Finance, Protect, and Insure Your Business
   - Put Together a Financial Plan
   - Obtain Financing for Your Business
   - Protect Your Business
8. Choose Your Location & Set Up for Business
   - Choose a Retail Business Location
   - Choose a Location for a Nonretail Business
   - Obtain Space and Design the Physical Layout
   - Purchase Equipment, Supplies, and Inventory
9. Market Your Business
   - The Marketing Mix
   - Product, Price, Distribution, Price, and Promotion
   - Set Marketing Goals
10. Hire and Manage a Staff
    - Hire Employees
    - Create a Compensation Package
    - Manage your Staff

11. Record-Keeping and Accounting
    - Set up a Record Keeping System
    - Understand Basic Accounting
    - Track Your Inventory
12. Financial Management
    - Manage your Cash Flow
    - Analyze Your Financial Performance
    - Hire Experts
13. Use Technology
    - Technology and Your Business
    - Learn about the Interest
    - Purchase Technology
14. Intellectual property Rights
    - Patents
    - Copyright
    - Industrial design rights
    - Trademarks
    - Trade secrets
15. Innovation Contest
    - Innovative Idea
    - Proof of Concept (PoC)
    - Prototype Creation
    - The students may be grouped into 2 to 3 and work under a project supervisor. The Prototypes to be fabricated may be decided in consultation with the supervisor. A innovative report to be submitted by the group and the model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department.

OUTCOMES

- Identify personal strengths and value systems.
- Recall important tenets of digital literacy.
- Discuss the essentials of matters pertaining to money.
- Prepare for employment and self-employment.
- Illustrate the basics of entrepreneurship and identify new business opportunities.

TOTAL: 15 PERIODS

19MDC401	VALUE ADDED COURSE – I	L T P C - - - -

OBJECTIVES

- Being able to carry out simple numerical computations and analyses using MATLAB.
- The objective of the course makes students capable to design their own projects PCB upto industrial grade.
- To prepare students with latest knowledge in mobile technology.
- The purpose of the course is to help circuit designers better understand the operation of a SPICE circuit simulator and semiconductor device models with emphasis on Deep- Submicron (DSM) transistors.

COURSE CONTENTS

1. **MATLAB**
2. **PCB DESIGN**
3. **MOBILE HARDWARE TROUBLE SHOTTING**
4. **PSPICE SIMULATION**

OUTCOMES

At the end of this course, the students are able to:

- Write simple programs in MATLAB to solve scientific and mathematical problems.
- Students are capable to produce PCB of their own circuit.
- Repair and Diagnose the Problem of all kinds of faults in Mobile Phone handsets in Hardware as well Software and rectify the faults using tools and equipment and various software.
- Analyze simple analog and digital circuits using PSpice software.

SEMESTER V

19ECT501 TRANSMISSION LINES AND WAVE GUIDES L T P C
3 0 0 3

OBJECTIVES

The student should be made to:

- Introduce the various types of transmission lines and to discuss the losses associated.
- Give thorough understanding about impedance transformation and matching.
- Use the Smith chart in problem solving.
- Impart knowledge on filter theories.
- Impart knowledge on waveguides theories.

UNIT I: TRANSMISSION LINE THEORY 9

General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion-less line - Loading and different methods of loading - Line not terminated in Z0 - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

UNIT II: HIGH FREQUENCY TRANSMISSION LINES 9

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

UNIT III: IMPEDANCE MATCHING IN HIGH FREQUENCY LINES 9

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

UNIT IV: PASSIVE FILTERS 9

Characteristic impedance of symmetrical networks - filter fundamentals, Design of filters: Constant K - Low Pass, High Pass, Band Pass, Band Elimination, m- derived sections - low pass, high pass composite filters.

UNIT V: WAVE GUIDES AND CAVITY RESONATORS 9

General Wave behaviors along uniform Guiding structures, Transverse Electromagnetic waves, Transverse Magnetic waves, Transverse Electric waves, TM and TE waves between parallel

plates, TM and TE waves in Rectangular wave guides, Bessel's differential equation and Bessel function, TM and TE waves in Circular wave guides, Rectangular and circular cavity Resonators.

TOTAL: 45 PERIODS

OUTCOMES

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

- Discuss the propagation of signals through transmission lines.
- Analyze signal propagation at Radio frequencies.
- Explain radio propagation in guided systems.
- Analyze the passive filters.
- Utilize cavity resonators.

TEXT BOOKS

1. John D Ryder. "Networks lines and fields",2nd Edition,Prentice Hall India,2010.
2. Reinhold Ludwig and Powel Bretchko, RF Circuit Design Theory and Applications, Pearson Education Asia, 1st Edition,2001.

REFERENCES

1. E.C.Jordan and K.G.Balmain, "Electromagnetic waves and Radiating Systems", Prentice Hall India,2006.
2. G.S.N Raju, "Electromagnetic Field Theory and Transmission Lines",Pearson Education , 1st edition 2005.

E-RESOURCES

1. https://nptel.ac.in/courses/117/101/117101056/(Transmission Lines and EM waves)
2. https://nptel.ac.in/courses/108/102/108102119/(Engineering Electromagnetics)

19ECT502	SOFT COMPUTING	L T P C 3 0 0 3

OBJECTIVES

The student should be made to:

- Learn the basic concepts of Soft Computing.
- Become familiar with various techniques like neural networks.
- Learn the concepts of Fuzzy systems.
- Understand the principles of Genetic algorithms.
- Apply soft computing techniques to in hybrid systems.

UNIT I: INTRODUCTION TO SOFT COMPUTING **9**

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

UNIT II: ARTIFICIAL NEURAL NETWORKS **9**

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization - Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory - Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

UNIT III: FUZZY SYSTEMS **9**

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

UNIT IV: GENETIC ALGORITHMS **9**

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators - Convergence of Genetic Algorithm.

UNIT V: HYBRID SYSTEMS **9**

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction - Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply suitable soft computing techniques for various applications.
- Artificial neural networks and its applications.
- Fuzzy logic and its applications.
- Solving multi-objectiove optimization problerms using Evolutionary algorithms.
- Integrate various soft computing techniques for complex problems.

TEXT BOOKS

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press,2015.
2. S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt.Ltd., 2nd Edition,2011.

REFERENCES

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, —Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2002.
2. Kwang H.Lee, —First course on Fuzzy Theory and Applications, Springer, 2005.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105173/ (Introduction to Soft Computing)
2. https://nptel.ac.in/content/storage2/courses/108108078/pdf/chap10/teach_slides10.pdf (Hybrid Systems)

19ECE502 **DIGITAL SIGNAL PROCESSING** **L T P C**
3 0 2 4

OBJECTIVES

To enable students to:

- Learn discrete fourier transform, properties of DFT.
- Understand the characteristics of digital filters, design digital IIR and FIR filters.
- Understand the fundamental concepts of multi rate signal processing and its applications.
- Introduce the concepts of adaptive filters and its application to communication engineering.
- Perform basic signal processing operations such as Convolution, Correlation,Filtering and Frequency analysis in MATLAB.

UNIT I: DISCRETE FOURIER TRANSFORM **9**

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 andsummation - scaling to prevent overflow.

UNIT V: INTRODUCTION TO DIGITAL SIGNAL PROCESSORS **9**

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

LIST OF EXPERIMENTS

MATLAB / EQUIVALENT SOFTWARE PACKAGE

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

DSP PROCESSOR BASED IMPLEMENTATION

1. Study of architecture of Digital Signal Processor
2. Perform MAC operation using various addressing modes
3. Generation of various signals and random noise.
4. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering.
5. Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass, High pass, Band pass and Band stop filtering.

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Apply DFT for the analysis of digital signals and systems.
- Design IIR and FIR filters.
- Characterize the effects of finite precision representation on digital filters.
- Design multirate filters.
- Apply adaptive filters appropriately in communication systems.
- Demonstrate their abilities towards MATLAB based implementation of various DSP systems.

TEXT BOOKS

1. John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing - Principles, Algorithms & Applications", 4th Edition, Pearson Education / Prentice Hall, 2007.
2. Emmanuel C. Ifeachor & Barrie. W. Jervis, "Digital Signal Processing", 2nd Edition, Pearson Education / Prentice Hall, 2002.

REFERENCES

1. V. Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing",8th Indian Reprint, Pearson, 2004.
2. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.

E-RESOURCES

1. https://nptel.ac.in/courses/117/102/117102060/ (Digital Signal Processing)
2. https://nptel.ac.in/courses/108/106/108106151/ (Digital Signal Processing)

19ECE503 MICROPROCESSORS AND MICROCONTROLLERS L T P C
3 0 2 4

OBJECTIVES

The student should be made to:

- Understand the Architecture of 8086 microprocessor.
- Learn the design aspects of I/O and Memory Interfacing circuits.
- Interface microprocessors with supporting chips.
- Study the Architecture of 8051 microcontroller.
- Design a microcontroller based system.

UNIT I: THE 8086 MICROPROCESSOR 9

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

UNIT II: 8086 SYSTEM BUS STRUCTURE 9

8086 signals - Basic configurations - System bus timing -System design using 8086 - I/O programming - Introduction to Multiprogramming - System Bus Structure - Multiprocessor configurations - Coprocessor, Closely coupled and loosely Coupled configurations - Introduction to advanced processors.

UNIT III: I/O INTERFACING 9

Memory Interfacing and I/O interfacing - Parallel communication interface - Serial communication interface - D/A and A/D Interface - Timer - Keyboard /display controller - Interrupt controller - DMA controller - Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

UNIT IV: MICROCONTROLLER 9

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

UNIT V: INTERFACING MICROCONTROLLER 9

Programming 8051 Timers - Serial Port Programming - Interrupts Programming - LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors.

LIST OF EXPERIMENTS

8086 Programs using kits and MASM

1. Basic arithmetic and Logical operations.
2. Move a data block without overlap.
3. Ascending Descending Order.

Peripherals and Interfacing Experiments

1. Stepper motor control.
2. Key board and Display.
3. A/D and D/A interface and Waveform Generation.

8051 Experiments using kits and MASM

1. Basic arithmetic and Logical operations.
2. Square and Cube program, Find 2's complement of a number.

TOTAL: 45+15=60 PERIODS

OUTCOMES:

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

- Understand and execute programs based on 8086 microprocessor.
- Design Memory Interfacing circuits.
- Design and interface I/O circuits.
- Design and implement 8051 microcontroller based systems.
- Develop counters and Time delay circuits.

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.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2nd Edition, Pearson education, 2011.

REFERENCES:

1. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware",TMH,2012.
2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata Mc Graw Hill, 2012.

E-RESOURCES:

1. https://nptel.ac.in/courses/108/105/108105102/ (Microprocessors and Microcontrollers)
2. https://nptel.ac.in/courses/106/108/106108100/ (Microprocessors and Microcontrollers)

19MDC501 **VALUE ADDED COURSE – II** **L T P C**
- - - -

OBJECTIVES

- Program a group of similar microcontrollers of one manufacturer.
- Compatible with normal Python as possible to allow you to transfer code with ease from the desktop to a microcontroller or embedded system.

COURSE CONTENTS

a. **ARTIFICIAL INTELLIGENCE WITH IOT**
b. **MIKRO C PRO**
c. **MICROPYTHON**

OUTCOMES

At the end of this course, the students are able to :

- Provided with all data on internal architecture of these microcontrollers, operation of particular circuits, instruction set, names of registers, their accurate addresses, pin-outs etc.
- Adapt MicroPython for personal use, in education, and in commercial products.

SEMESTER VI

19ECT601 ANTENNAS AND WAVE PROPAGATION L T P C
3 1 0 4

OBJECTIVES

To enable students to:

- Fundamental antenna parameters and numerical methods.
- Analyze and differentiate the antennas.
- Concept of radiation mechanism of various antennas.
- Knowledge of antenna measurement methods.
- Mechanism and models for radio-wave propagation.

UNIT I: FUNDAMENTALS OF RADIATION 9+3

Definition of antenna parameters - Gain, Directivity, Effective aperture, Radiation Resistance, Band width, Beam width, Input Impedance. Matching - Baluns, Polarization mismatch, Antenna noise temperature, Radiation from oscillating dipole, Half wave dipole. Folded dipole, Yagi array.

UNIT II: APERTURE AND SLOT ANTENNAS 9+3

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

UNIT III: ANTENNA ARRAYS 9+3

Letter N element linear array, Pattern multiplication, Broadside and End fire array - Concept of Phased arrays, Adaptive array, Basic principle of antenna Synthesis-Binomial array, Uniformly spaced arrays with uniform and non-uniform excitation amplitudes, Smart antennas.

UNIT IV: SPECIAL ANTENNAS 9+3

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, Antenna Measurements-Test Ranges, Measurement of Gain, Radiation pattern, Polarization, VSWR.

UNIT V: PROPAGATION OF RADIO WAVES 9+3

Modes of propagation , Structure of atmosphere , Ground wave propagation , Tropospheric propagation , Duct propagation, Troposcatter propagation , Flat earth and Curved earth concept

Sky wave propagation - Virtual height, critical frequency , Maximum usable frequency -Skipdistance, Fading , Multi hop propagation.

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Define various antenna parameters.
- Design and analyze antenna arrays.
- Explain the various types of antennas and wave propagation.
- Analyze the antenna arrays, aperture antennas and special antennas such as frequency independent and broad band.
- Identify the characteristics of radio-wave propagation.

TEXT BOOKS

1. John D Kraus," Antennas for all Applications", 3rd Edition, Mc Graw Hill, 2005.
2. Robert S.Elliott "Antenna Theory and Design" Wiley Student Edition, 2006.

REFERENCES

1. Constantine.A.Balanis "Antenna Theory Analysis and Design", Wiley Student Edition, 2006.
2. S. Drabowitch, "Modern Antennas" 2nd Edition, Springer Publications, 2007

E-RESOURCES

1. https://nptel.ac.in/courses/108/101/108101092/ (Antennas)
2. https://nptel.ac.in/courses/117/101/117101056/ (Advance Antenna theory)

19ECT602	WIRELESS COMMUNICATION	L T P C 3 0 0 3

OBJECTIVES

To enable students to:

- Study the characteristic of wireless Channel.
- Understand the design of a cellular system.
- Study the various digital signaling techniques and multipath mitigation techniques.
- Understand the concepts of multiple antenna techniques.
- Understand the concepts behind various digital signaling schemes for fading channels.

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 CHANNEL **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

OUTCOMES

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

- Characterize a wireless channel and evolve the system design specifications.
- Design a cellular system based on resource availability and traffic demands.
- Identify suitable signaling and multipath mitigation techniques for the wireless channel and system under consideration.
- Design and implement various signaling schemes for fading channels.
- Design and implement systems with transmit/receive diversity and MIMO systems andanalyze their performance.

TEXT BOOKS

1. Rappaport,T.S., "Wireless communications", Pearson Education, 2nd Edition,2010.
2. Andreas.F. Molisch, "Wireless Communications", John Wiley - India, 2006.

REFERENCES

1. Wireless Communication - Andrea Goldsmith, Cambridge University Press, 2011
2. Van Nee, R. and Ramji Prasad, "OFDM for wireless multimedia communications, ArtechHouse", 2000.

E-RESOURCES

1. https://nptel.ac.in/courses/117/102/117102062/ (Wireless communications)
2. https://nptel.ac.in/courses/106/106/106106167/ (Introduction To Wireless And Cellular Communication)

19ECT603 **COMMUNICATION NETWORKS** **L T P C**
3 0 0 3

OBJECTIVES

The student should be made to:

- 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.
- Understand and design application layer protocols and internet applications such as DNS,E- Mail

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.

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 - Network layer protocols (IP, ICMP, Mobile IP).

UNIT IV: TRANSPORT LAYER **9**

Introduction to Transport layer - Protocols- User Datagram Protocols (UDP) and TransmissionControl 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) - Cryptography and Network Security - Firewalls.

TOTAL: 45 PERIODS

OUTCOMES

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

- Identify the components required to build different types of networks.
- Choose the required functionality at each layer for given application.
- Identify solution for each functionality at each layer.
- Trace the flow of information from one node to another node in the network.
- Identify solution for each functionality at Application layer.

TEXT BOOK

1. Behrouz A. Forouzan, "Data communication and Networking", 5th Edition, Tata McGraw - Hill, 2013.
2. James F. Kurose, Keith W. Ross, "Computer Networking - A Top-Down Approach Featuring the Internet", 7th Edition, Pearson Education, 2016.

REFERENCES

1. Nader. F. Mir,"Computer and Communication Networks", Pearson Prentice Hall Publishers, 2nd Edition, 2014.
2. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 5thEdition, Morgan Kaufmann Publishers, 2011.

E-RESOURCES

1. https://nptel.ac.in/courses/117/105/117105076/ (Communication Networks and Switching).
2. https://nptel.ac.in/courses/106/105/106105082/ (Data Communication).

19ECE601 **VLSI DESIGN** **L T P C**
3 0 2 4

OBJECTIVES

To enable students to:

- Study the fundamentals of CMOS circuits and its characteristics.
- Learn the design and realization of combinational Logic circuits.
- Learn the design and realization of Sequential circuits.
- Study the FPGA architectures and testability of VLSI circuits.
- Design VHDL code for combinational circuits and sequential circuits

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 Characteristics, 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: 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.

UNIT V: IMPLEMENTATION STRATEGIES AND TESTING **9**

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: Ad Hoc Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan.

LIST OF EXPERIMENTS

Digital System Design using HDL & FPGA

1. Design an Adder & Multiplier (Min 8 Bit) using HDL. Simulate it usingXilinx/Altera Software and implement by Xilinx/Altera FPGA.
2. Design an ALU using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
3. Design a Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.
4. Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.

Digital Circuit Design

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

Analog Circuit Design

8. Design and Simulate a CMOS Inverting Amplifier.
9. Design and Simulate basic Common Source, Common Gate and Common Drain Amplifiers.

TOTAL: 45+15=60 PERIODS

OUTCOMES:

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

- Write HDL code for basic as well as advanced digital integrated circuit.
- Import the logic modules into FPGA Boards.
- Synthesize Place and Route the digital IPs.
- Design, Simulate and Extract the layouts of Digital & Analog IC Blocks using EDA tools.
- Familiarize fusing of logical modules on FPGAs.
- Provide hands on design experience with professional design (EDA) platforms.

TEXT BOOKS

1. Neil H.E. Weste, David Money Harris —CMOS VLSI Design: A Circuits and Systems Perspective‖, 4th Edition, Pearson , 2017.
2. Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic, Digital Integrated Circuits:A Design perspective‖, 2nd Edition , Pearson , 2016.

REFERENCES

1. M.J. Smith, "Application Specific Integrated Circuits", Addisson Wesley, 1997.
2. Wayne Wolf, "Modern VLSI Design: System On Chip", Pearson Education, 2007.

E-RESOURCES

1. https://nptel.ac.in/courses/117/101/117101058/ (VLSI Design)
2. https://onlinecourses.nptel.ac.in/noc20_ee29/preview (CMOS Digital VLSI Design)

19ECE602 **DIGITAL COMMUNICATION** **L T P C**
3 0 2 4

OBJECTIVES

To enable students to:

- Introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- Demonstrate the concept of information and types of channels.
- Understand the various source coding theorems and the fundamental limit of transmission over the channel.
- Understand the various baseband and bandpass processing techniques.
- Understand spread spectrum.
- Simulate and validate the various functional modules of a communication system.

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.

LIST OF EXPERIMENTS:

1. Implementation and Generation of ASK, FSK, and BPSK schemes.
2. Implementation and Generation of DPSK, QPSK and QAM schemes.
3. Simulation of signal constellations of BPSK, QPSK and QAM.
4. Implementation and Detection of ASK, FSK and BPSK schemes.
5. Simulation of Linear Block and Cyclic Error Control coding schemes.
6. Performance Analysis of Convolutional coding Scheme.
7. Performance Analysis of Communication link.
8. Analysis of Spectral efficiency of MODEM.

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Be able to design Channel coding schemes.
- Be able to design base band signaling scheme analyze their performance.
- Capable of designing synchronization schemes.
- Capable of designing spread spectrum systems.
- Simulate and validate the various functional modules of a communication system.
- Simulate end-to-end communication Link.

TEXT BOOKS

1. S. Haykin, "Digital Communications", John Wiley, 2005
2. J.G Proakis, —Digital Communication‖, 4th Edition, Tata Mc Graw Hill Company, 2001

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.

E-RESOURCES

1. https://nptel.ac.in/courses/117/101/17101051/(Digital Communication)
2. https://nptel.ac.in/courses/108/101/108101113/(Principles of Digital Communication)

19ECJ601	MINI PROJECT	L T P C 0 0 2 1

OBJECTIVES

The main objective of this course is to:

- Design and fabrication of one or more components of a complete working model, which is designed by them.
- Ability to fabricate any components using different manufacturing tools.

GUIDELINES FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a committee constituted by the Head of the Department. At the end of the semester examination 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.

TOTAL: 60 PERIODS

OUTCOMES

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

- Design and fabricate the machine element or the mechanical product.
- Demonstrate the working model of the machine element or the mechanical product.

SEMESTER VII

19ECT701 **OPTICAL COMMUNICATION** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- Study about the various optical fiber modes, configuration and transmission characteristics of optical fibers.
- Learn about the transmission Characteristic of optical fiber
- Learn about the various optical sources, detectors and transmission techniques.
- Explore various idea about optical fiber measurements and various coupling techniques.
- Enrich the knowledge about optical communication systems and networks.

UNIT I: INTRODUCTION TO OPTICAL FIBERS 9

Introduction-general optical fiber communication system- basic optical laws and definitionsoptical modes and configurations -mode analysis for optical propagation through fibers modes in planar wave guide-modes in cylindrical optical fiber-transverse electric and transverse magnetic modes- fiber materials-fiber fabrication techniques-fiber optic cables classification of optical fiber-single mode fiber-graded index fiber.

UNIT II: TRANSMISSION CHARACTERISTIC OF 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-optimization of single mode fiber-characteristics of single mode fiber-R-I Profile cutoff wave length-dispersion calculation-mode field diameter.

UNIT III: OPTICAL SOURCES AND DETECTORS 9

Sources: Intrinsic and extrinsic material-direct and indirect band gaps-LED and its Characteristics -LASER diodes and its characteristics. Detectors: PIN photo detector-Avalanche photo diodes-Photo detector noise-noise sources- SNR-detector response time-Avalanche multiplication noise-temperature effects comparisons of photo detectors.

UNIT IV: OPTICAL RECEIVER, MEASUREMENTS AND COUPLING 9

Fundamental receiver operation-preamplifiers-digital signal transmission-error sources-Front end amplifiers-digital receiver performance-probability of error-receiver sensitivity-quantum limit. Optical power measurement - attenuation measurement-dispersion measurement- Fiber Numerical Aperture Measurements- Fiber cut- off Wave length Measurements- Fiber diameter measurements-Source to Fiber Power Launching-Lensing Schemes for Coupling Management-Fiber to Fiber Joints-LED Coupling to Single Mode Fibers-Fiber Splicing-Optical Fiber connectors.

UNIT V: OPTICAL COMMUNICATION SYSTEMS AND NETWORKS 9

System design consideration Point - to - Point link design - Link power budget - rise time budget, WDM - Passive DWDM Components-Elements of optical networks-SONET/SDH Optical Interfaces-SONET/SDH Rings and Networks-High speed light wave Links-OADM configuration- Optical ETHERNET-Soliton.

TOTAL: 45 PERIODS

OUTCOMES

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

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

TEXT BOOKS

1. P Chakrabarti, "Optical Fiber Communication", McGraw Hill Education (India) PrivateLimited, 2016.
2. Gred Keiser,"Optical Fiber Communication", McGraw Hill Education (India) Private Limited. 5th Edition, Reprint 2013.

REFERENCES

1. John M.Senior, "Optical fiber communication", Pearson Education, Second edition, 2007.
2. Rajiv Ramaswami, "Optical Networks", 2nd Edition, Elsevier, 2004.

E-RESOURCES

1. https://nptel.ac.in/courses/117/101/117101054/ (Optical Communication)
2. https://nptel.ac.in/courses/117/104/117104127/ (Optical Communications)

19ECE701 **MICROWAVE ENGINEERING** **L T P C**
3 0 2 4

OBJECTIVES

To enable students to:

- Understanding of the basics required for circuit representation of microwave design.
- An ability to design microwave matching networks.
- Deal with the issues in the design of microwave amplifier.
- Deal with the microwave generation and microwave measurement techniques.
- Gain knowledge about various microwave components with regard to communication.
- Enhance the knowledge in the area of microwave components and antenna for practical applications.

UNIT I: TWO PORT NETWORK THEORY **9**

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

UNIT II: RF AMPLIFIERS AND MATCHING NETWORKS **9**

Characteristics of Amplifiers, Amplifier power relations, Stability considerations, Stabilization Methods, Noise Figure, Constant VSWR, Broadband, High power and Multistage Amplifiers, Impedance matching using discrete components, Two component matching Networks,Frequency response and quality factor, T and Pi Matching Networks, Microstrip Line Matching Networks.

UNIT III: PASSIVE AND ACTIVE MICROWAVE DEVICES **9**

Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, attenuator, resonator, Principles of Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes Schottky Barrier diodes, PIN diodes.

UNIT IV: MICROWAVE TUBE **9**

Microwave tubes: Limitations of conventional active devices at microwave frequency, Two cavity Klystron, Reflex Klystron, Magnetron, Traveling wave tube, Backward wave oscillators, Gyro Devices: Their schematic, Principle of operation, Performance characteristic and their applications.

UNIT V: MICROWAVE DESIGN PRINCIPLES **9**

Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave

Amplifier Design, Microwave Power amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design.

LIST OF EXPERIMENTS

MICROWAVE EXPERIMENTS

1. Gunn Diode - Characteristics.
2. VSWR, Frequency and Wave Length Measurement.
3. Directional Coupler - Directivity and Coupling Coefficient - S - parameter measurement.
4. Isolator and Circulator - S - parameter measurement.

OPTICAL EXPERIMENTS

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

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Explain the active & passive microwave devices & components used in Microwave communication systems.
- Analyze the multi- port RF networks and RF transistor amplifiers.
- Generate Microwave signals and design microwave amplifiers.
- Measure and analyze Microwave signal and parameters.
- Demonstrate the characteristics of Microwave sources and Directional Couplers.
- To test the characteristics of microwave components and optical fibers.

TEXT BOOKS

1. Robert E Colin, "Foundations for Microwave Engineering", John Wiley & Sons Inc, 2005.
2. David M. Pozar, "Microwave Engineering", 4th Edition, Wiley India, 2012.

REFERENCES

1. Constantine A.Balanis, —"Antenna Theory Analysis and Design", 3rd edition, JohnWiley India Pvt Ltd., 2005.

2. Annapurna Das and Sisir K Das, "Microwave Engineering", Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2005.

E-RESOURCES

1. https://nptel.ac.in/courses/108/103/108103141(Microwave Engineering)
2. https://nptel.ac.in/courses/108/101/108101112/(Microwave Theory and Techniques)

19ECE702 **EMBEDDED SYSTEMS** **L T P C**
3 0 2 4

OBJECTIVES

To enable students to:

- Introduce the relevance of this course to the existing technology through demonstrations.
- Introduce case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- Study the architecture and programming of ARM processors.
- Introduce the basic concepts of hard real time multiprocessing.
- Introduce the analytical concepts for effective programming.
- Introduce the basic concepts of Communication protocol.

UNIT I: INTRODUCTION TO EMBEDDED COMPUTING AND ARM PROCESSORS 9

Complex systems and microprocessors - Embedded system design process - Formalism forsystem design - Design example: Model train controller- ARM Processor Fundamentals- Instruction Set and Programming using ARM Processor.

UNIT II: COMPUTING PLATFORM 9

CPU: Programming input and output - Supervisor mode, exception and traps - Coprocessor - Memory system mechanism - CPU performance - CPU power consumption- CPU buses - Memory devices - I/O devices - Component interfacing- System Level Performance Analysis-Parallelism. Design Example: Data Compressor.

UNIT III: PROGRAM DESIGN AND ANALYSIS 9

Program design - Model of programs - Assembly and Linking - Basic compilation techniques - Program Optimization- Analysis and optimization of execution time, power, energy, program size - Program validation and testing- Example: Software Modem.

UNIT IV: PROCESS AND OPERATING SYSTEMS 9

Multiple tasks and Multi processes - Processes - Context Switching - Operating Systems - Priority based Scheduling- RMS and EDF - Inter Process Communication mechanisms - Evaluating operating system performance - Power optimization strategies for processes.

UNIT V: HARDWARE ACCELERATORS & NETWORKS 9

Multiprocessors- CPUs and Accelerators - Performance Analysis- Distributed Embedded Architecture - Networks for Embedded Systems:- I2C, CAN Bus, Ethernet, Myrinet - Network based design - Internet enabled systems. Design Example: Elevator Controller.

LIST OF EXPERIMENTS

1. Study of ARM evaluation system.
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
7. Mailbox.
8. Interrupt performance characteristics of ARM and FPGA.
9. Flashing of LEDS.
10. Interfacing stepper motor and temperature sensor.
11. Implementing zigbee protocol with ARM.

TOTAL: 45+15=60 PERIODS

OUTCOMES

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

- Ability to design and develop ARM processor based system
- Ability to comprehend and appreciate the significance and role of microcontrollers in embedded systems.
- Ability to analyze and demonstrate program design and optimization and proper scheduling of the process.
- Ability to apply the concept of process, multiprocesses and operating systems in embedded system design.
- Ability to implement various communication protocols in distributed embedded computing platform.
- Ability to design and develop ARM Processor based Programming.

TEXT BOOKS

1. Wayne Wolf, "Computers as Components - Principles of Embedded Computing System Design", Morgan Kaufmann Publisher (An imprint of Elsevier), 3rd edition, 2008.
2. Andrew N Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide-Designing and Optimizing System Software", Elsevier/Morgan Kaufmann Publisher, 2008.

REFERENCES

1. David E-Simon, "An Embedded Software Prime", Pearson Education, 2010.
2. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dreamtech press, 2005.

E-RESOURCES

1. https://nptel.ac.in/courses/108/102/108102045/ (Embedded Systems)
2. https://nptel.ac.in/courses/106/105/106105193/(Embedded System Design with ARM)

19ECJ701 **PROJECT WORK (PHASE - I)** **L T P C**
0 0 2 1

OBJECTIVES

The main objective of this course is to:

- Identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
- Build up skills to formulate a technical project.
- Develop the methodology to solve the identified problem.
- Teach use of new tools, algorithms and techniques required to carry out the projects.
- Train the students in preparing project reports and to face reviews and viva-voce examination.

GUIDELINE FOR REVIEW AND EVALUATION

The students in a group of 3 works on a topic approved by the head of the department under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of engineering design. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

TOTAL: 15 PERIODS

OUTCOMES

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

- Formulate a real world problem, identify the requirement and develop the design solutions.
- Identify technical ideas, strategies and methodologies.
- Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.
- Prepare technical report and oral presentations.
- At the end of the course the students will have a clear idea of their area of work and they will be in a position to carry out the remaining phase II work in a systematic way.

SEMESTER VIII

19ECJ801 **PROJECT WORK (PHASE - II)** **L T P C**
0 0 20 10

OBJECTIVES

The main objective of this course is to:

- Develop skills to formulate a technical project.
- Develop the ability to solve specific problem.
- Teach use of new tools, algorithms and techniques required to carry out the projects.
- Give guidance on the various procedures for validation of the product and analyze the cost effectiveness.
- Provide guidelines to prepare technical report of the project.

GUIDELINE FOR REVIEW AND EVALUATION

The students in a group of 3 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 300 PERIODS

OUTCOMES

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

- Formulate a real world problem, identify the requirement and develop the design solutions.
- Identify technical ideas, strategies and methodologies.
- Test and validate through conformance of the developed prototype and analysis the cost effectiveness.
- Prepare technical report and oral presentations.
- On completion of the project work students will be in a position to take up any challenging practical problem in the field of engineering and find better solutions to it.

PROFESSIONAL ELECTIVE-I

19ECPX01 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.
- Learn the Bio-potential recording and also the method of transmitting physiological parameters.
- Study about the various assist devices used in the hospitals.
- Gain knowledge about equipment used for physical medicine.
- Understand the various recentlydeveloped diagnostic and therapeutic techniques.

UNIT I: ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9

Sources of biomedical signals, Bio-potentials, Bio-potential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics.

UNIT II: BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT 9

pH, PO2, PCO2, Colorimeter, 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.

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.

TOTAL: 45 PERIODS

OUTCOMES

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

- Know the human body electro- physiological parameters and recording of bio-potentials.
- Comprehend the non-electrical physiological parameters and their measurement –

- body temperature, blood pressure, pulse, blood cell count, blood flow meter etc.
- Interpret the various assist devices used in the hospitals viz. pacemakers, defibrillators,
  dialyzers and ventilators.
- Comprehend physical medicine methods eg. ultrasonic, shortwave, microwave surgicaldiathermies , and bio-telemetry principles and methods.
- Know about recent trends in medical instrumentation.

TEXT BOOKS

1. Leslie Cromwell, ―Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi, 2007.
2. Khandpur, R.S., ―Handbook of Biomedical Instrumentation‖, TATA Mc Graw-Hill, NewDelhi, 2003.

REFERENCES

1. John G.Webster, ―Medical Instrumentation Application and Design‖, 3rd Edition, WileyIndia Edition, 2007.
2. Joseph J.Carr and John M.Brown, ―Introduction to Biomedical EquipmentTechnology‖,John Wiley and Sons, New York, 2004.

E-RESOURCES

1. https://nptel.ac.in/courses/102/106/102106069/ (Material And Energy Balances)
2. https://nptel.ac.in/content/storage2/courses/downloads_new/112106248/noc18_me55 _As signment13.pdf (Assist Devices)

19ECPX02 **OPERATING SYSTEMS** **L T P C**
3 0 0 3

OBJECTIVES

The student should be made to:

- Understand the basic concepts and functions of operating systems.
- Understand Processes and Threads.
- Analyze Scheduling algorithms and various memory management schemes.
- Understand the concept of Deadlocks.
- Understand I/O management and File systems.
- Be familiar with the basics of Linux system and Mobile OS like iOS and Android.

UNIT I: OPERATING SYSTEM OVERVIEW **7**

Computer System Overview-Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System.- Computer System Organization Operating System Structure and Operations- System Calls, System Programs, OS Generation and System Boot.

UNIT II: PROCESS MANAGEMENT **11**

Processes - Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues; Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III: STORAGE MANAGEMENT **9**

Main Memory - Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory - Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples.

UNIT IV: FILE SYSTEMS AND I/O SYSTEMS **9**

Mass Storage system - Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management; File-System Interface - File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery; I/O Systems - I/O Hardware, Application I/O interface, Kernel I/O subsystem, Streams, Performance.

UNIT V: CASE STUDY **9**

Linux System - Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, Input-Output Management, File System, Interprocess Communication; Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OSLayer, File System.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze various scheduling algorithms.
- Understand deadlock, prevention and avoidance algorithms.
- Compare and contrast various memory management schemes.
- Understand the functionality of file systems.
- Perform administrative tasks on Linux Servers and compare iOS and Android Operating Systems.

TEXT BOOKS

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, —Operating System Concepts, 9th Edition, John Wiley and Sons Inc., 2012.
2. Ramaz Elmasri, A. Gil Carrick, David Levine,- Operating Systems- A Spiral Approach ,Tata McGraw Hill Edition, 2010.

REFERENCES

1. Achyut S.Godbole, Atul Kahate, - Operating Systems‖, McGraw Hill Education, 2016.
2. Andrew S. Tanenbaum, - Modern Operating Systems ‖, 2nd Edition, PearsonEducation, 2004.

E-RESOURCES

1. https://nptel.ac.in/courses/106/106/106106144/ (Introduction To Operating Systems)
2. https://nptel.ac.in/courses/106/105/106105214/ (Operating Systems Fundamentals)

19ECPX03 ROBOTICS AND AUTOMATION L T P C
3 0 0 3

OBJECTIVES

The student should be made to:

- Understand the basic concepts associated with the design, functioning, applications and social aspects of robots.
- Study about the electrical drive systems and sensors used in robotics for various applications.
- Learn about analyzing robot kinematics, dynamics through different methodologies and study various design aspects of robot arm manipulator and end-effector.
- Learn about various motion planning techniques and the associated control architecture.
- Understand the implications of AI and other trending concepts of robotics.

UNIT I: FOUNDATION FOR BEGINNERS 9

Introduction -- brief history, definition, anatomy, types, classification, specification and need based applications; role and need of robots for the immediate problems of the society, future of mankind and automation-ethical issues; industrial scenario local and global, case studies on mobile robot research platform and industrial serial arm manipulator.

UNIT II: BUILDING BLOCKS OF A ROBOT 9

Types of electric motors - DC, Servo,Stepper; specification, drives for motors - speed & direction control and circuitry, Selection criterion for actuators, direct drives, non-traditional actuators; Sensors for localization, navigation, obstacle avoidance and path planning in known and unknown environments-optical,inertial, thermal, chemical, biosensor,other common sensors; Case study on choice of sensors and actuators for maze solving robot and self driving cars.

UNIT III: KINEMATICS, DYNAMICS AND DESIGN OF ROBOTS & END-EFFECTORS 9

Robot kinematics - Geometric approach for 2R, 3R manipulators, homogenous transformation using D-H representation, kinematics of WMR, Lagrangian formulation for 2R robot dynamics; Mechanical design aspects of a 2R manipulator, WMR; End-effector - common types and design case study.

UNIT IV: NAVIGATION, PATH PLANNING AND CONTROL ARCHITECTURE **9**

Mapping & Navigation - SLAM, Path planning for serial manipulators; types of control architectures - Cartesian control, Force control and hybrid position/force control, Behaviour based control, application of Neural network, fuzzy logic, optimization algorithms for navigation problems, programming methodologies of a robot.

UNIT V: AI AND OTHER RESEARCH TRENDS IN ROBOTICS **9**

Application of Machine learning - AI, Expert systems; Tele-robotics and Virtual Reality, Micro & Nanorobots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids.

TOTAL: 45 PERIODS

OUTCOMES

The student should be able to:

- Explain the concepts of industrial robots in terms of classification, specifications and coordinate systems, along with the need and application of robots & automation.
- Examine different sensors and actuators for applications like maze solving andself drivingcars.
- Design a 2R robot & an end-effector and solve the kinematics and dynamics of motionfor robots.
- Explain navigation and path planning techniques along with the control architectures adopted for robot motion planning.
- Describe the impact and progress in AI and other research trends in the field of robotics.

TEXT BOOKS

1. Saeed. B. Niku, Introduction to Robotics, Analysis, system, Applications, Pearsoneducations, 2002.
2. Roland Siegwart, Illah Reza Nourbakhsh, Introduction to Autonomous Mobile Robots, MIT Press, 2011.

REFERENCES

1. Richard David Klafter, Thomas A. Chmielewski, Michael Negin, Robotic engineering: anintegrated approach, Prentice Hall, 1993.
2. Robin Murphy, Introduction to AI Robotics, MIT Press, 2000.

E-RESOURCES

1. https://nptel.ac.in/courses/112/101/112101098/ (Robotics)
2. https://nptel.ac.in/courses/112/107/112107289/ (Robotics And Control)

19ECPX04 NANO TECHNOLOGY AND APPLICATIONS L T P C
3 0 0 3

OBJECTIVES

To enable students to:

- Provide a broad view of the nascent field of nanoscience and nanotechnology to undergraduates.
- Explore the basics of nanomaterial synthesis and characterization.
- Introduce the applications of nanotechnology.
- Learn the concept of fabrication in nano materials.
- Study the various applications of nano technology.

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 NANOMATERIALS 9

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

OUTCOMES

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

- Describe the basic science behind the properties of materials.
- Interpret the creation, characterization, and manipulation of nanoscale materials.
- Comprehend the exciting applications of nanotechnology at the leading edge of scientific research.
- Apply their knowledge of nanotechnology to identify how they can be exploited for new applications.
- Implement the concepts of nano technology in various fields such as diagnostics, environmental and agricultural.

TEXT BOOKS

1. Springer Handbook of Nanotechnology by Bharat Bhushan 2004.
2. Encyclopedia of Nanotechnology - Hari Singh Nalwa 2004.

REFERENCES

1. Nanomaterials, Nanotechnologies and Design: an Introduction to Engineers and Architects, D. Michael Ashby, Paulo Ferreira, Daniel L. Schodek, Butterworth-Heinemann, 2009.
2. Handbook of Nanophase and Nanostructured Materials (in four volumes), Eds: Z.L. Wang, Y. Liu, Z. Zhang, Kluwer Academic/Plenum Publishers, 2003.

E-RESOURCES

1. https://nptel.ac.in/courses/113/106/113106093/ (Nanotechnology Science And Applications)
2. https://nptel.ac.in/courses/118/102/118102003/ (Nano Structured Material, - Synthesis, Properties, Self Assembly And Applications)

19ECPX05 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES

To enable students to:

- Acquire various concepts of quality management.
- Implement various principles of quality management.
- Impart quality using statistical process.
- Use the various tools to maintain quality.
- Implement the quality system for ISO certification.

UNIT I: INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

UNIT II: TQM PRINCIPLES 9

Leadership - Quality statements - Strategic quality planning - Quality councils - Employee involvement - Motivation, empowerment, team and teamwork, recognition, reward and performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership, partnering, supplier selection, supplier rating.

UNIT III: TQM TOOLS AND TECHNIQUES - I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, methodology, applications to manufacturing, service sector including IT - Bench marking, reason to bench mark, bench marking process - FMEA - Stages, types.

UNIT IV: TQM TOOLS AND TECHNIQUES - II 9

Quality circles - Cost of quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V: QUALITY MANAGEMENT SYSTEM 9

Introduction - Benefits of ISO registration - ISO 9000 series of standards - Specific standards- AS 9100, TS16949 and TL 9000 - ISO 9001 requirements - Implementation - Documentation- Internal audits - Registration - Environmental Management System: Introduction - ISO 14000 series standards - Concepts of ISO 14001 - Requirements of ISO 14001 - Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES

At the end of the course:

- Students can acquire various concepts of quality management.
- Students can implement various principles of quality management.
- Students will be able to impart quality using statistical process.
- Students can learn to use the various tools to maintain quality.
- Students can implement the quality system for ISO certification.

TEXT BOOKS

1. Dale H.Besterfiled, , "Total Quality Management", Pearson Education Asia, Revised, IndianReprint, Sixth Impression, 3rd Edition, 2013.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2011.

REFERENCES

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", First Indian Edition, Cengage Learning, 8th Edition, 2012.
2. Subburaj ramasamy, " Total Quality Management", McGraw Hill Education, Noiad,2011.

E- RESOURCES

1. https://nptel.ac.in/courses/110/104/110104080/(TOTAL QUALITY MANAGEMENT -I)
2. https://nptel.ac.in/courses/110/105/110105088/ (Quality Design and Control)

19ECPX06 CRYPTOGRAPHY AND NETWORK SECURITY L T P C
3 0 0 3

OBJECTIVES

To enable students to:

- Understand Cryptography Theories, Algorithms and Systems.
- Understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks**.**
- Understand the fundamental concepts cryptography applications.
- Study the various types of system security.
- Understand the fundamental concepts cryptography applications.

UNIT I: INTRODUCTION 9

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security - Security attacks, services and mechanisms - OSI security architecture - Classical encryption techniques: substitution techniques, transposition techniques, steganography).- Foundations of modern cryptography: perfect security - information theory - product cryptosystem - cryptanalysis.

UNIT II: SYMMETRIC CRYPTOGRAPHY 9

MATHEMATICS OF SYMMETRIC KEY CRYPTOGRAPHY: Algebraic structures - Modular arithmetic-Euclid's algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES - Block cipher Principles of DES - Strength of DES - Differential and linear cryptanalysis - Block cipher design principles - Block cipher mode of operation - Evaluation criteria for AES - Advanced Encryption Standard - RC4 - Key distribution.

UNIT III: PUBLIC KEY CRYPTOGRAPHY 9

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes - Primality Testing - Factorization - Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem - Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem - Key distribution - Key management - Diffie Hellman key exchange - ElGamal cryptosystem - Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT IV: MESSAGE AUTHENTICATION AND INTEGRITY 9

Authentication requirement - Authentication function - MAC - Hash function - Security of hash function and MAC - SHA - Digital signature and authentication protocols -DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509.

UNIT V: SECURITY PRACTICE AND SYSTEM SECURITY **9**

Electronic Mail security - PGP, S/MIME - IP security - Web Security - SYSTEM SECURITY: Intruders - Malicious software - viruses - Firewalls.

TOTAL: 45 PERIODS

OUTCOMES

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

- Understand the fundamentals of networks security, security architecture, threats and vulnerabilities.
- Apply the different cryptographic operations of symmetric cryptographic algorithms.
- Apply the different cryptographic operations of public key cryptography.
- Apply the various Authentication schemes to simulate different applications.
- Understand various Security practices and System security standards.

TEXT BOOKS

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 3rd Edition, 2006.
2. C. K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd.

REFERENCES

1. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
2. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105031/ (Cryptography and Network Security)
2. https://nptel.ac.in/courses/106/106/106106221/ (foundation of cryptography)

PROFESSIONAL ELECTIVE – II

19ECPX07 **COMPUTER ARCHITECTURE** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- Make students understand the basic structure and operation of digital computer.
- Familiarize with implementation of fixed point and floating-point arithmetic operations.
- Study the design of data path unit and control unit for processor.
- Understand the concept of various memories and interfacing.
- Introduce the parallel processing technique**.**

UNIT I: INTRODUCTION 9

Basics of a computer system: Evolution, Ideas, Technology, Performance, Power wall, Uniprocessors to Multiprocessors. Addressing and addressing modes. Instructions: Operations and Operands, Representing instructions, Logical operations, control operations.

UNIT II: ARITHMETIC 9

Fixed point Addition, Subtraction, Multiplication and Division. Floating Point arithmetic, High performance arithmetic, Subword parallelism.

UNIT III: THE PROCESSOR 9

Introduction, Logic Design Conventions, Building a Datapath - A Simple Implementation scheme - An Overview of Pipelining - Pipelined Datapath and Control. Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions.

UNIT IV: MEMORY AND I/O ORGANIZATION 9

Memory hierarchy, Memory Chip Organization, Cache memory, Virtual memory. Parallel Bus Architectures, Internal Communication Methodologies, Serial Bus Architectures, Mass storage, Input and Output Devices.

UNIT V: ADVANCED COMPUTER ARCHITECTURE 9

Parallel processing architectures and challenges, Hardware multithreading, Multicore and shared memory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers - Introduction to Multiprocessor network topologies.

TOTAL: 45 PERIODS

OUTCOMES

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

- Describe data representation, instruction formats and the operation of a digital computer.
- Illustrate the fixed point and floating-point arithmetic for ALU operation.
- Discuss about implementation schemes of control unit and pipeline performance.
- Explain the concept of various memories, interfacing and organization of multiple processors.
- Discuss parallel processing technique and unconventional architectures.

TEXT BOOKS

1. David A. Patterson and John L. Hennessey, "Computer Organization and Design",5th edition, Morgan Kauffman / Elsevier, 2014.
2. Miles J. Murdocca and Vincent P. Heuring, "Computer Architecture and Organization: An Integrated approach", 2nd edition, Wiley India Pvt Ltd, 2015.

REFERENCES

1. V. Carl Hamacher, Zvonko G. Varanesic and Safat G. Zaky, "Computer Organization", 5th edition, Mc Graw-Hill Education India Pvt Ltd, 2014. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2.
2. William Stallings ,"Computer Organization and Architecture", 7th Edition, Pearson Education, 2006.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105163/(Computer Architecture and Organization)
2. https://nptel.ac.in/courses/106/103/106103206/(Advanced Computer Architecture)

19ECPX08 MULTIMEDIA COMPRESSION AND COMMUNICATION L T P C
3 0 0 3

OBJECTIVES

To enable students to:

- Understand the compression schemes for text, voice, image and video.
- Understand the QoS issues in multimedia network.
- Know the communication protocols for multimedia networking.
- Learn the different compression techniques.
- Study the network performance parameters of guaranteed service model.

UNIT I: AUDIO COMPRESSION 9

Sampling and Quantization of Speech (PCM) - Adaptive differential PCM - Delta Modulation - Vector Quantization- Linear predictive coding (LPC) - Code excited Linear predictive Coding (CELP).

UNIT II: IMAGE AND VIDEO COMPRESSION 9

Graphics Interchange format- Tagged image file format-Digitized documents- Digitized picturesJPEG-Video Encoding-Motion estimation - Overview of H.263 and MPEG-2.

UNIT III: TEXT COMPRESSION 9

Static and Dynamic Huffman coding - Arithmetic coding - Lempel-Ziv coding - LZW coding.

UNIT IV: GUARANTEED SERVICE MODEL 9

Best Effort service model - Scheduling and Dropping policies - Network Performance Parameters - Quality of Service and metrics - WFQ and its variants - Random Early Detection - QoS aware Routing - Admission Control - Resource Reservation - RSVP - Traffic Shaping Algorithms - Caching - Laissez Faire Approach - Possible Architectures -An Overview of QoSArchitectures.

UNIT V: MULTIMEDIA COMMUNICATION 9

Stream characteristics for Continuous media - Temporal Relationship - Object Stream Interactions, Media Levity, Media Synchronization - Models for Temporal Specifications - Streaming of Audio and Video - Jitter - Fixed playout and Adaptive playout - Recovering frompacket loss - RTSP-Multimedia Communication Standards- RTP/RTCP -SIPand H.263.

TOTAL: 45 PERIODS

OUTCOMES

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

- Design audio compression techniques.
- Configure Text, image and video compression techniques.
- Select suitable service model for specific application.
- Configure multimedia communication network.
- Analyse the multimedia communication standards.

TEXT BOOKS

1. Fred Halsall, "Multimedia communication- Applications, Networks, Protocols and Standards", Pearson education, 2007.
2. Tay Vaughan, "Multimedia Making it work", McGraw-Hill Osborne Media, 2006.

REFERENCES

1. KR. Rao,Z S Bojkovic, D A Milovanovic, "Multimedia Communication Systems: Techniques, Standards, and Networks", Pearson Education 2007.
2. Nalin K Sharda, "Multimedia Information Networking", Prentice Hall of India, 1999.

E-RESOURCES

1. https://nptel.ac.in/courses/117/105/117105083/(Multimedia Processing)
2. https://nptel.ac.in/courses/117/105/117105081/(Digital Voice & Picture Communication)

19ECPX09 **CMOS ANALOG IC DESIGN** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- Study the fundamentals of analog circuits and MOS device models.
- Gain knowledge on various configurations of MOS transistors and feedback concepts**.**
- Study the characteristics of noise and frequency response of the amplifier.
- Learn the concepts of Op-Amp frequency compensation, capacitor switches and PLL.
- Understand the concept of switched capacitor circuits and PLL.

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 mirrorsActive 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 responseDifferential 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 AmpsGeneral consideration of stability and frequency compensation- Multipole system- Phase marginFrequency 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 PLLCharge pump PLLs - Non ideal Effects in PLLs- Delay locked loops- its Applications.

TOTAL:45 PERIODS

OUTCOMES

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

- Realize the concepts of Analog MOS devices and current mirror circuits.
- Design different configuration of Amplifiers and feedback circuits.
- Analyze the characteristics of frequency response of the amplifier and its noise.
- Analyze the performance of the stability and frequency compensation techniques of Op-amp Circuits.
- Construct switched capacitor circuits and PLLs.

TEXT BOOKS

1. Behzad Razavi, —Design of Analog CMOS Integrated Circuits‖, Tata McGraw Hill,2001, 33rd re-print, 2016.
2. Phillip Allen and Douglas Holmberg —CMOS Analog Circuit Design‖ 2nd Edition, Oxford University Press, 2004.

REFERENCES

1. Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design of Analog Integrated Circuits, 5th Edition, Wiley, 2009.
2. Grebene, —Bipolar and MOS Analog Integrated circuit design‖, John Wiley & sons, Inc.,2003.

E-RESOURCES

1. https://nptel.ac.in/courses/117/106/108106105/(Analog IC Design)
2. https://nptel.ac.in/courses/117/101/117101105/(CMOS Analog VLSI Design)

19ECPX10 **WIRELESS NETWORKS** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- Understand the concept about Wireless networks, protocol stack and standards.
- Understand and analyse the network layer solutions for Wireless networks.
- Study about fundamentals of 3G Services, its protocols and applications.
- Have in depth knowledge on internetworking of WLAN and WWAN.
- 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 UTMS 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 AND 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

OUTCOMES

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

- Conversant with the latest 3G/4G networks and its architecture.
- Design and implement wireless network environment for any application using latest wireless protocols and standards.
- Ability to select the suitable network depending on the availability and requirement.
- Understand the concepts of various 4G Technologies.
- Implement different type of applications for smart phones and mobile devices with latest network strategies.

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 andLTE for Mobile Broadband", 2nd Edition, Academic Press, 2008.
2. Anurag Kumar, D.Manjunath, Joy kuri, "Wireless Networking", 1st Edition, Elsevier 2011.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105160/ (Wireless ad hoc and sensor network)
2. https://freevideolectures.com/course/4240/nptel-evolution-air-interface-towards-g(Evolution of Air Interface towards 5G)

19ECPX11 **INTELLECTUAL PROPERTY RIGHTS** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- Give an idea about IPR, registration and its enforcement.
- Understand the concepts of copy rights, Trade marks, Patents.
- Study the digital products and law.
- Learn about Enforcement of IPRs.
- Understand the agreements and legislations of IPR.

UNIT I: INTRODUCTION **9**

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights,Geographical Indications, IPR in India and Abroad - Genesis and Development - the way fromWTO to WIPO - TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations - Important examples of IPR.

UNIT II: REGISTRATION OF IPRs **9**

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad.

UNIT III: AGREEMENTS AND LEGISLATIONS **9**

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV: DIGITAL PRODUCTS AND LAW **9**

Digital Innovations and Developments as Knowledge Assets - IP Laws, Cyber Law and Digital Content Protection - Unfair Competition - Meaning and Relationship between Unfair Competition and IP Laws - Case Studies.

UNIT V: ENFORCEMENT OF IPRs **9**

Infringement of IPRs, Enforcement Measures, Emerging issues - Case Studies.

TOTAL: 45 PERIODS

OUTCOMES

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

- Ability to manage Intellectual Property portfolio to enhance the value of the firm.
- Know the process of Registration of IPR.

- Understand the various patent act of India.
- Explore the knowledge of digital products.
- Enforcement of various agreement and legislation.

TEXT BOOKS

1. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012.
2. S. V. Satakar, "Intellectual Property Rights and Copy Rights", Ess Ess Publications, NewDelhi, 2002.

REFERENCES

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, 3rd Edition, 2012.
2. Prabuddha Ganguli, "Intellectual Property Rights: Unleashing the Knowledge Economy",McGraw Hill Education, 2011.

E-RESOURCES

1. https://nptel.ac.in/courses/110/105/110105139/ (Intellectual Property Rights and Competition Law)
2. https://nptel.ac.in/courses/109/106/109106137/ (Intellectual Property)

19ECPX12 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT L T P C
3 0 0 3

OBJECTIVES

To enable students to:

- Understand the global trends and development methodologies of various types of products and services.
- 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.
- Understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification.
- Understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics.
- 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

OUTCOMES

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

- Define, formulate and analyze a problem.
- Solve specific problems independently or as part of a team.
- Gain knowledge of the Innovation & Product Development process in the Business Context.
- Work independently as well as in teams.
- Manage a project from start to finish.

TEXT BOOKS

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.

REFERENCES

1. Hiriyappa B, —Corporate Strategy - Managing the Business‖, Author House, 2013.
2. Vinod Kumar Garg and Venkita Krishnan N K, "Enterprise Resource Planning - Concepts", 2nd Edition, Prentice Hall, 2003.

E-RESOURCES

1. https://nptel.ac.in/courses/112/107/112107217/ (Product Design and Development)
2. https://nptel.ac.in/courses/106/103/106103116/ (Design Verification and Test of Digital VLSI Circuits)

PROFESSIONAL ELECTIVE – III

19ECPX13 **MACHINE LEARNING TECHNIQUES** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- Understand the need for machine learning for various problem solving.
- Study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning.
- Learn the new approaches in machine learning.
- Design appropriate machine learning algorithms for problem solving.
- Implement the different models in machine learning.

UNIT I: INTRODUCTION **9**

Learning Problems - Perspectives and Issues - Concept Learning - Version Spaces and Candidate Eliminations - Inductive bias - Decision Tree learning - Representation - Algorithm - Heuristic Space Search.

UNIT II: NEURAL NETWORKS AND GENETIC ALGORITHMS **9**

Neural Network Representation - Problems - Perceptrons - Multilayer Networks and Back Propagation Algorithms - Advanced Topics - Genetic Algorithms - Hypothesis Space Search - Genetic Programming - Models of Evaluation and Learning.

UNIT III: BAYESIAN AND COMPUTATIONAL LEARNING **9**

Bayes Theorem - Concept Learning - Maximum Likelihood - Minimum Description Length Principle - Bayes Optimal Classifier - Gibbs Algorithm - Naïve Bayes Classifier - Bayesian Belief Network - EM Algorithm - Probability Learning - Sample Complexity - Finite and InfiniteHypothesis Spaces - Mistake Bound Model.

UNIT IV: INSTANT BASED LEARNING **9**

K- Nearest Neighbour Learning - Locally weighted Regression - Radial Bases Functions - Case Based Learning.

UNIT V: ADVANCED LEARNING **9**

Learning Sets of Rules - Sequential Covering Algorithm - Learning Rule Set - First Order Rules-Sets of First Order Rules - Induction on Inverted Deduction - Inverting Resolution-Analytical Learning - Perfect Domain Theories - Explanation Base Learning - FOCL Algorithm - Reinforcement Learning - Task - Q-Learning - Temporal Difference Learning

TOTAL: 45 PERIODS

OUTCOMES

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

- Differentiate between supervised, unsupervised, semi-supervised machine learning approaches.
- Apply specific supervised or unsupervised machine learning algorithm for a particular problem.
- Analyse and suggest the appropriate machine learning approach for the various types of problem.
- Design and make modifications to existing machine learning algorithms to suit a individual application.
- Provide useful case studies on the advanced machine learning algorithms.

TEXT BOOKS

1. Tom M. Mitchell, ―Machine Learning‖, McGraw-Hill Education (India) Private Limited,2013.
2. Jason Bell, ―Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014

REFERENCES

1. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and MachineLearning)", The MIT Press 2004.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", CRC Press, 2009.

E-RESOURCES

1. https://nptel.ac.in/courses/106/106/106106139/("Introduction to Machine Learning)
2. https://nptel.ac.in/courses/106/106/106106198/(Machine Learning for engineering and science applications)

19ECPX14 **DEEP LEARNING** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to,

- Understand complexity of Deep Learning algorithms and their limitations.
- Understand modern notions in data analysis oriented computing.
- Be capable of confidently applying common Deep Learning algorithms in practice andimplementing their own.
- Be capable of performing experiments in Deep Learning using real-world data anddistributed computations.
- Learn the various application of Deep learning.

UNIT I: INTRODUCTION **9**

Introduction to Tensor Flow :Computational Graph, Key highlights, Creating a Graph, Regression example, Gradient Descent, Tensor Board, Modularity, Sharing Variables, Keras Perceptrons: What is a Perceptron, XOR Gate.

UNIT II: ARTIFICIAL NEURAL NETWORKS **9**

Activation Functions : Sigmoid,ReLU, Hyperbolic Fns,Softmax, Artificial Neural Networks : Introduction, Perceptron Training Rule, Gradient Descent Rule.

UNIT III: OPTIMIZATION AND REGULARIZATION **9**

Gradient Descent and Back propagation: Gradient Descent, Stochastic Gradient Descent, Back propagation, Some problems in ANN, Optimization and Regularization :Overfitting and Capacity, Cross Validation, Feature Selection, Regularization, Hyperparameters.

UNIT IV: CONVOLUTIONAL NEURAL NETWORKS **9**

Introduction to Convolutional Neural Networks: Introduction to CNNs, Kernel filter, Principles behind CNNs, Multiple Filters, CNN applications, Introduction to Recurrent Neural Networks: Introduction to RNNs, Unfolded RNNs, Seq2Seq RNNs, LSTM, RNN applications.

UNIT V: APPLICATIONS **9**

Image Processing, Natural Language Processing, Speech Recognition, Video Analytics

TOTAL: 45 PERIODS

OUTCOMES

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

- Understand the concepts of TensorFlow, its main functions, operations and the execution pipeline.
- Implement deep learning algorithms.
- Understand neural networks and traverse the layers of data abstraction which will empower the student to understand data more precisely.
- Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces.
- Understand the concepts of Artificial Neural networks.

TEXT BOOKS

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006.

REFERENCES

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
2. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105215/(Deep Learning)
2. https://nptel.ac.in/courses/106/106/106106184/(Deep Learning- part 1)

19ECPX15 ELECTROMAGNETIC INTERFERENCE AND COMPATIBILITY L T P C
3 0 0 3

OBJECTIVES

To enable students to:

- Introduce the basic concepts of Electromagnetic Interference.
- Teach the importance of Electromagnetic Compatible designs.
- Explain the existing standards for Electromagnetic Compatibility.
- Understand various EMI control techniques
- Learn the various Electromagnetic Interference measurements and standards.

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; Power mains and Power supply coupling; Transient EMI, ESD.

UNIT III: EMI CONTROL 9

Shielding; EMI Filters; Grounding; Bonding; Isolation transformer; Transient suppressors; EMI Suppression Cables.

UNIT IV: EMC DESIGN FOR CIRCUITS AND PCBS 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; VIAs; 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

OUTCOMES

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

- Identify the various types and mechanisms of Electromagnetic Interference.
- Propose a suitable EMI mitigation technique.

- Describe the various EMC Standards and methods to measure them.
- Implement various coupling of EMI.
- Learn EMC design for circuits and PCB'S.

TEXT BOOKS

1. V.P.Kodali, "Engineering EMC Principles, Measurements and Technologies", IEEE Press, Newyork, 1996.
2. Henry W.Ott., "Noise Reduction Techniques in Electronic Systems", A Wiley Inter Science Publications, John Wiley and Sons, Newyork, 1988.

REFERENCES

1. C.R.Paul, "Introduction to Electromagnetic Compatibility" , John Wiley and Sons, Inc, 1992.
2. Bemhard Keiser, "Principles of Electromagnetic Compatibility", 3rd Ed, Artech house, Norwood, 1986.

E-RESOURCES

1. https://nptel.ac.in/courses/108/106/108106138/ (Electromagnetic Compatibility)
2. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ee17/(Electromagnetic Compatibility)

19ECPX16 **COMPRESSIVE SENSING** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- Present the basic theory and ideas showing when it is possible to reconstruct sparseor nearly sparse signals from under sampled data.
- Expose students to recent ideas in modern convex optimization allowing rapid signal recovery.
- Understand the basics of wireless sensor with and without compressive sensing
- Learn the recovery of real time sparse signals in noiseless and noisy environments.
- Give students a sense of real time applications that might benefit from compressive sensing ideas.

UNIT I: INTRODUCTION TO COMPRESSED SENSING **9**

Introduction; Motivation; Mathematical Background; Traditional Sampling; Traditional Compression; Conventional Data Acquisition System; Drawbacks of Transform coding; Compressed Sensing (CS).

UNIT II: PARSITY AND SIGNAL RECOVERY **9**

Signal Representation; Basis vectors; Sensing matrices; Restricted Isometric Property; Coherence; Stable recovery; Number of measurements.

UNIT III: RECOVERY ALGORITHMS **9**

Basis Pursuit algorithm: L1 minimization; Matching pursuit: Orthogonal Matching Pursuit(OMP), Stagewise OMP, Regularized OMP, Compressive Sampling Matching Pursuit (CoSaMP); Iterative Thresholding algorithm: Hard thresholding, Soft thresholding; Model based : Model based CoSaMP, Model based HIT.

UNIT IV: COMPRESSIVE SENSING FOR WSN **9**

Basics of WSN; Wireless Sensor without Compressive Sensing; Wireless Sensor with Compressive Sensing; Compressive Wireless Sensing: Spatial compression in WSNs, Projections in WSNs, Compressed Sensing in WSNs.

UNIT V: APPLICATIONS OF COMPRESSIVE SENSING **9**

Compressed Sensing for Real-Time Energy-Efficient Compression on Wireless Body Sensor Nodes; Compressive sensing in video surveillance; An Application of Compressive Sensing for Image Fusion; Single-Pixel Imaging via Compressive Sampling.

TOTAL: 45 PERIODS

OUTCOMES

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

- Appreciate the motivation and the necessity for compressed sensing technology.
- Design a new algorithm or modify an existing algorithm for different application areas in wireless sensor network.
- Implement the spatial compressing in wireless sensor networks.
- Discuss the applications of Compressive sensing in image fusion and in video surveillance.
- Understand the concept of Compressive sampling matching pursuit .

TEXT BOOKS

1. Radha S, Hemalatha R, Aasha Nandhini S, "Compressive Sensing for Wireless Communication: Challenges and Opportunities", River publication, 2016.
2. Mark A. Davenport, Marco F. Duarte, Yonina C. Eldar and Gitta Kutyniok, "Introduction to Compressed Sensing", in Compressed Sensing: Theory and Applications, Y. Eldar and G. Kutyniok, eds., Cambridge University Press, 2011.

REFERENCES

1. Duarte, M.F.; Davenport, M.A.; Takhar, D.; Laska, J.N.; Ting Sun; Kelly, K.F.; Baraniuk, R.G.; , "Single-Pixel Imaging via Compressive Sampling," Signal Processing Magazine, IEEE, vol.25, no.2, pp.83-91, March 2008.
2. Tao Wan.; Zengchang Qin.; , "An application of compressive sensing for image fusion", CIVR'10 Proceedings of the ACM International Conference on Image and Video Retrieval, Pages 3-9.

E-RESOURCES

1. https://nptel.ac.in/courses/128/106/128106011/ (ACM Summer School on Algorithmic and Theoretical Aspects of Machine Learning,2019)
2. https://nptel.ac.in/courses/108/104/108104112/ (Applied Optimization for Wireless, Machine Learning, Big Data)

19ECPX17 **DIGITAL IMAGE PROCESSING** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to,

- Become familiar with digital image fundamentals
- Get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- Learn concepts of degradation function and restoration techniques.
- Study the image segmentation and representation techniques.
- 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

OUTCOMES

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

- Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
- Operate on images using the techniques of smoothing, sharpening and enhancement.
- Understand the restoration concepts and filtering techniques.
- Learn the basics of segmentation, features extraction, compression and recognition methods for color models.
- Discuss the concept of image segmentation by morphological watershed.

TEXT BOOKS

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, 3rd Edition, 2010.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson, 2002.

REFERENCES

1. Kenneth R. Castleman, "Digital Image Processing", Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing using MATLAB", Pearson Education, Inc., 2011.

E-RESOURCES

1. https://nptel.ac.in/courses/117/105/117105079/(Digital Image Processing)
2. https://nptel.ac.in/courses/117/105/117105135/(Digital Image Processing)

19ECPX18 PROFESSIONAL ETHICS IN ENGINEERING L T P C
3 0 0 3

OBJECTIVES

To enable students to:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.
- Discuss the roles of professional in the society.
- Explain the codes and conduct of Engineers.
- Discuss the responsibility, rights of employees in an organization.
- Understand the recent issues in the world such as weapons development, computer crimes.

UNIT I: HUMAN VALUES 10

Morals, values and Ethics - Integrity - Work ethic - Service learning - Civic virtue - Respect for others -Living peacefully -Caring - Sharing - Honesty - Courage - Valuing time - Cooperation - Commitment- Empathy - Self confidence - Character -Spirituality - Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II: ENGINEERING ETHICS 9

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

UNIT III: ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation - Engineers as responsible Experimenters - Codes of Ethics - A Balanced Outlook on Law.

UNIT IV: SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk - Assessment of Safety and Risk - Risk Benefit Analysis and Reducing Risk - Respect for Authority - Collective Bargaining - Confidentiality - Conflicts of Interest - Occupational Crime - Professional Rights - Employee Rights - Intellectual Property Rights (IPR) - Discrimination.

UNIT V: GLOBAL ISSUES **8**

Multinational Corporations - Environmental Ethics - Computer Ethics - Weapons Development - Engineers as Managers - Consulting Engineers - Engineers as Expert Witnesses and Advisors - Moral Leadership - Code of Conduct - Corporate Social Responsibility.

TOTAL: 45 PERIODS

OUTCOMES

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

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.
- Learn the moral theories and models of professional roles.
- Study the concept of Engineer acted as social experimenter.
- Discuss safety, risk benefit analysis and Reduces the risk.
- Understand the concept of engineer as manager, consultant and advisors.

TEXT BOOKS

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey,2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics - Concepts and Cases", Cengage Learning, 2009.

E-RESOURCES

1. https://nptel.ac.in/courses/110/105/110105097/ (Ethics in Engineering practice)
2. https://nptel.ac.in/courses/110/107/110107112/ (Global Marketing Management)

PROFESSIONAL ELECTIVE – IV

19ECPX19	DSP PROCESSOR ARCHITECTURE AND PROGRAMMING	L T P C 3 0 0 3

OBJECTIVES

To enable students to:

- Basics on Digital Signal Processors.
- Programmable DSP's Architecture, On-chip Peripherals and Instruction set.
- Programming for signal processing applications.
- Advanced Programmable DSP Processors.
- ADSP and NXP DSP 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 chipPeripherals, 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 kit (DSK) - Software Tools, DSKon-board peripherals, Application Programs for processing real time signals.

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 Blackfin and Sigma DSP Processors, NXP's DSP56Fxx Family of DSP Processors, Comparison of thefeatures of TI, ADSP and NXP DSP family processors.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze the concepts of Digital Signal Processors.
- Demonstrate their ability to program the DSP processor for signal processing applications.
- Discuss, compare and select the suitable Advanced DSP Processors for real-time signalprocessing applications.
- Implement filter design and FFT calculation.
- Programming Examples for Signals and Noise generation, Frequency analysis and Filter design.

TEXT BOOKS

1. B. Venkataramani and M. Bhaskar, ―Digital Signal Processors - Architecture, Programming and Applications‖ - Tata McGraw - Hill Publishing Company Limited. New Delhi, 2003.
2. Avtar Singh and S. Srinivasan, Digital Signal Processing - Implementations using DSP Microprocessors with Examples from TMS320C54xx, Cengage Learning India Private Limited, Delhi 2012.

REFERENCES

1. Rulph Chassaing and Donald Reay, Digital Signal Processing and Applications with the C6713 and C6416 DSK, John Wiley & Sons, Inc., Publication, 2012 (Reprint).
2. User guides Texas Instruments, Analog Devices and NXP.

E-RESOURCES

1. https://nptel.ac.in/courses/108/106/108106149/(Mapping Signal Processing Algorithms to Architectures)
2. https://nptel.ac.in/courses/117/105/117105075/(Adaptive Signal Processing)

19ECPX20 **SATELLITE COMMUNICATION** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- 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

OUTCOMES

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

- Analyze the satellite orbits.
- Analyze the earth segment and space segment.
- Analyze the satellite Link design.
- Design various satellite applications.
- Apply concepts to satellite networks.

TEXT BOOKS

1. Dennis Roddy, - Satellite Communication‖, 4th Edition, Mc Graw Hill International, 2006.
2. Timothy,Pratt,Charles,W.Bostain,JeremyE.Allnutt,"SatelliteCommunication‖ ,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.

E-RESOURCES

1. https://nptel.ac.in/courses/117/105/117105131/ (Satellite Communication systems)
2. https://nptel.ac.in/courses/105/107/105107194/ (Global Navigation Satellite Systems and Applications)

19ECPX21 **DISASTER MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- Provide students an exposure to disasters, their significance and types.
- Ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction.
- Gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- Enhance awareness of institutional processes in the country.
- Develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity.

UNIT I: INTRODUCTION TO DISASTERS **9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks - Disasters: Types of disasters - Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II: APPROACHES TO DISASTER RISK REDUCTION (DRR) **9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) - Early Warning System - Advisories from Appropriate Agencies.

UNIT III: INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT **9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV: DISASTER RISK MANAGEMENT IN INDIA **9**

Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation - Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster - Disaster Damage Assessment.

UNIT V: DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES ANDFIELD WORKS **9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES

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

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.
- Develop Rudimentary ability to respond their surroundings with potential disaster response in living area.
- Create awareness of institutional process in India.

TEXT BOOKS

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427ISBN- 13: 978-9380386423.
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India EducationPvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361].

REFERENCES

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005.
2. Government of India, National Disaster Management Policy, 2009.

E-RESOURCES

1. https://nptel.ac.in/courses/124/107/124107010/ (Disaster Recovery and Build Back Better)
2. https://nptel.ac.in/courses/105/104/105104183/ (Natural Hazards)

19ECPX22 PRINCIPLES OF SPEECH PROCESSING L T P C
3 0 0 3

OBJECTIVES

To enable students to:

- Understand the speech production mechanism and the various speech analysis techniques and speech models.
- Understand the speech compression techniques.
- Understand the speech recognition techniques.
- Know the speaker recognition and text to speech synthesis.
- Learn linear predictive coding.

UNIT I: SPEECH SIGNAL CHARACTERISTICS & ANALYSIS 9

Speech production process – speech sounds and features- - Phonetic Representation of Speech representing speech in time and frequency domains – Short-Time Analysis of Speech – Short-Time Energy and Zero-Crossing Rate – Short-Time Autocorrelation Function – Short-Time Fourier Transform (STFT) – Speech Spectrum – Cepstrum – Mel-Frequency Cepstrum Coefficients – Hearing and Auditory Perception – Perception of Loudness – Critical Bands – Pitch Perception.

UNIT II: SPEECH COMPRESSION 9

Sampling and Quantization of Speech (PCM) – Adaptive differential PCM – Delta Modulation – Vector Quantization- Linear predictive coding (LPC) – Code excited Linear predictive Coding (CELP).

UNIT III: SPEECH RECOGNITION 9

LPC for speech recognition- Hidden Markov Model (HMM)- training procedure for HMM- subword unit model based on HMM- language models for large vocabulary speech recognition – Overall recognition system based on subword units – Context dependent subword units- Semantic post processor for speech recognition.

UNIT IV: SPEAKER RECOGNITION 9

Acoustic parameters for speaker verification- Feature space for speaker recognition-similarity measures- Text dependent speaker verification-Text independent speaker verification techniques.

UNIT V: SPEAKER RECOGNITION AND TEXT TO SPEECH SYNTHESIS 9

Text to speech synthesis(TTS)-Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness-role of prosody.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze and study the speech signal characteristics.
- Design speech compression techniques.
- Configure speech recognition techniques.
- Design speaker recognition systems.
- Design text to speech synthesis systems.

TEXT BOOKS

1. L. R. Rabiner and R. W. Schafer, Introduction to Digital Signal Processing, Foundations and Trends in Signal Processing Vol. 1, Nos. 1 - 2 (2007) 1 - 194.
2. Ben Gold and Nelson Morgan —Speech and Audio signal processing- processing and perception of speech and music, John Wiley and sons 2006.

REFERENCES

1. Lawrence Rabiner, Biiing and - Hwang Juang and B.Yegnanarayana —Fundamentals of Speech Recognition, Pearson Education, 2009.
2. Claudio Becchetti and Lucio Prina Ricotti, —Speech Recognition, John Wiley and Sons,1999.

E-RESOURCES

1. https://nptel.ac.in/courses/117/105/117105145/ (Digital Speech Processing).
2. https://nptel.ac.in/content/storage2/courses/117105145/pdf/Week_7_Lecture_Material.p df (Speech Technology Processing Applications).

19ECPX23 **DESIGNING WITH FPGA'S** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- Understand Digital system design using HDL.
- Know FPGA architecture, interconnect and technologies.
- Know different FPGA's and implementation methodologies.
- Understand configuring and implementing digital embedded system, microcontrollers, microprocessors, DSP algorithm on FPGA.
- Implementation exercises of combinational, sequential and DSP kernels on Xilinx/Altera boards.

UNIT I: INTRODUCTION **9**

Digital system design options and tradeoffs, Design methodology and technology overview, High Level System Architecture and Specification: Behavioral modelling and simulation, Hardware description 5 languages, combinational and sequential design, state machine design, synthesis issues, test benches.

UNIT II: OVERVIEW OF FPGA ARCHITECTURES AND TECHNOLOGIES **9**

FPGA Architectural options, granularity of function and wiring resources, coarse V/s fine grained, vendor specific issues (emphasis on Xilinx and Altera), Logic block architecture: FPGA logic cells, timing models, power dissipation I/O block architecture: Input and Output cell characteristics, clock input, Timing, Power dissipation.

UNIT III: PLACEMENT AND ROUTING **9**

Programmable interconnect - Partitioning and Placement, Routing resources, delays; Applications - Embedded system design using FPGAs, DSP using FPGAs, Dynamic architecture using FPGAs, reconfigurable systems, application case studies.

UNIT IV: FPGA PROGRAMMING **9**

System-level architecture design for FPGAs- Synthesizable VHDL- Practical testbench design, performance testing - Design, optimize, simulate, and analyze performance for a digital application.

UNIT V: APPLICTIONS **9**

Simulation/implementation exercises of combinational, sequential and DSP kernels on Xilinx/Altera boards.

TOTAL: 45 PERIODS

OUTCOMES

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

- Design reconfigurable digital systems.
- Demonstrate and Debug the embedded systems before the actual product is developed.
- Design finite state machines for various applications.
- Design dynamic architectures using FPGA's.
- Implement, Design and develop embedded system using EDA tools.

TEXT BOOKS

1. W.Wolf, "FPGA based system design", Pearson, 2004
2. M.J.S. Smith, "Application Specific Integrated Circuits", Pearson, 2000.

REFERENCES

1. Peter Ashenden, "Digital Design using VHDL", Elsevier, 2007.
2. Clive Maxfield, "The Design Warriors's Guide to FPGAs", Elsevier, 2004.

E-RESOURCES

1. https://nptel.ac.in/courses/117/108/117108040/ (Digital System Design with PLDs AND FPGAs).
2. https://nptel.ac.in/content/storage2/courses/108105057/Pdf/Lesson-20.pdf (Field Programmable Gate Arrays and Applications).

19ECPX24	MEMS AND NEMS	L T P C 3 0 0 3

OBJECTIVES

To enable students to:

- Introduce the concepts of micro and nano electromechanical devices.
- Know the fabrication process of Microsystems.
- Know the design concepts of micro sensors and micro actuators.
- Introduce the concepts of quantum mechanics and nano systems.
- Explain design of Acoustic wave sensors.
- Discuss ZnO nanorods based NEMSdevice.

UNIT I: INTRODUCTION TO MEMS AND NEMS **9**

Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Materials for MEMS and NEMS: Silicon, silicon compounds, polymers, metals.

UNIT II: MEMS FABRICATION TECHNIQUES **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

OUTCOMES

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

- Interpret the basics of micro/nano electromechanical systems including their applications and advantages.

- Recognize the use of materials in micro fabrication and describe the fabrication processes.
- Analyze the key performance aspects of electromechanical transducers including sensors and actuators.
- Comprehend the theoretical foundations of quantum mechanics and Nano systems
- Discuss applications of MEMS and NEMS.

TEXT BOOKS

1. Marc Madou, "Fundamentals of Microfabrication", CRC press 1997.
2. Stephen D. Senturia,"Micro system Design", Kluwer Academic Publishers,2001.

REFERENCES

1. Tai Ran Hsu , "MEMS and Microsystems Design and Manufacture" ,Tata Mcraw Hill, 2002.
2. Chang Liu, "Foundations of MEMS", Pearson education India limited, 2006.

E-RESOURCES

1. https://nptel.ac.in/courses/117/105/117105082/ (MEMS And Microsystems).
2. https://nptel.ac.in/courses/108/108/108108147/ (Sensors And Actuators).

OPEN ELECTIVE – I

19ECOX01 **INTERNET OF THINGS** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- Understand the basics of IoT.
- Get knowledge about the various services provided by IoT.
- Familiarize themselves with various communication techniques and networking.
- Know the implementation of IoT with different tools.
- Evaluate design issues in IoT applications.

UNIT I: INTRODUCTION TO INTERNET OF THINGS 9

Rise of the machines - Evolution of IoT - Web 3.0 view of IoT - Definition and characteristics of IoT - IoT Enabling Technologies - IoT Architecture - - Fog, Edge and Cloud in IoT - Functionalblocks of an IoT ecosystem - Sensors, Actuators, Smart Objects and Connecting Smart Objects - IoT levels and deployment templates - A panaromic view of IoT applications.

UNIT II: MIDDLEWARE AND PROTOCOLS OF IOT 9

Middleware technologies for IoT system (IoT Ecosystem Overview - Horizontal Architecture Approach for IoT Systems - SOA based IoT Middleware) Middleware architecture of RFID,WSN,SCADA,M2M - Interoperability challenges of IoT-Protocols for RFID,WSN,SCADA,M2M- Zigbee, KNX,BACNet,MODBUS - Challenges Introduced by 5G in IoT Middleware(Technological Requirements of 5G Systems - Perspectives and a Middleware Approach Toward 5G (COMPaaS Middleware) - Resource management in IoT.

UNIT III: COMMUNICATION AND NETWORKING 9

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN - Network Layer: IP versions, Constrained Nodes and Constrained Networks - Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks - Application Transport Methods: Supervisory Control and Data Acquisition - Application Layer Protocols: CoAP and MQTT-Data aggregation& dissemination.

UNIT IV: IOT IMPLEMENTATION TOOLS **9**

Introduction to Python, Introduction to different IoT tools, Developing applications through IoT Tools, developing sensor based application through embedded system platform, Implementing IoT concepts with python, Implementation of IoT with Raspberry Pi.

UNIT V: APPLICATIONS AND CASE STUDIES **9**

Home automations - Smart cities - Environment - Energy - Retail - Logistics - Agriculture - Industry - Health and life style - Case study.

TOTAL: 45 PERIODS

OUTCOMES

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

- Articulate the main concepts, key technologies, strength and limitations of IoT.
- Identify the architecture, infrastructure models of IoT.
- Analyze the networking and how the sensors are communicated in IoT.
- Identify and design the new models for market strategic interaction.
- Analyze various M2M and IoT architectures (Analyze)

TEXT BOOKS

1. Honbo Zhou, "Internet of Things in the cloud:A middleware perspective", CRC press, 2012.
2. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", VPT, 1st Edition, 2014.

REFERENCES

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press.
2. Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet ofThings" Springer-Verlag Berlin Heidelberg, 2011.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105166/ (Introduction To Internet Of Things).
2. https://nptel.ac.in/courses/117/105/117105076/ (Communication Networks And Switching).

19ECOX02 ADVANCED WIRELESS COMMUNICATION L T P C
3 0 0 3

OBJECTIVES

To enable students to:

- Expose the students to the importance of improving capacity of wireless channel using MIMO.
- Enable understanding of channel impairment mitigation using space-time block and Trellis codes.
- Teach advanced MIMO system like layered space time codes, MU-MIMO System and MIMO-OFDM systems.
- Understand Concepts of MIMO diversity and spatial multiplexing.
- Learn Massive MIMO system.

UNIT I: CAPACITY OF WIRELESS CHANNELS 9

The crowded spectrum, need for high data rate, MIMO systems - Array Gain, Diversity Gain, Data Pipes, Spatial MUX, MIMO System Model. MIMO System Capacity - channel known at the TX, Channel unknown to the TX - capacity of deterministic channels, Random channels and frequency selective channels.

UNIT II: RADIO WAVE PROPAGATION 9

Radio wave propagation - Macroscopic fading- free space and out door, small scale fading Fading measurements - Direct pulse measurements, spread spectrum correlation channel sounding frequency domain channel sounding, Antenna Diversity - Diversity combining methods.

UNIT III: SPACE TIME BLOCK CODES 9

Delay Diversity scheme, Alamoti space time code - Maximum likelihood decoding maximum ratio combining. Transmit diversity space time block codes for real signal constellation and complex signal constellation - decoding of STBC.

UNIT IV: SPACE TIME TRELLIS CODES 9

Space time coded systems, space time code word design criteria, design of space time T C on slow fading channels, design of STTC on Fast Fading channels, performance analysis in slow and fast fading channels, effect of imperfect channel estimation and Antenna correlation on performance, comparison of STBC & STTC.

UNIT V: LAYERED SPACE TIME CODES **9**

LST transmitter - Horizontal and Vertical LST receiver - ML Rx, Zero forcing Rx; MMSE Rx, IC Rx, ZF V-blast Rx- MMSE V-blast Rx, Iterative Rx - capacity of MIMO - OFDM systems - capacity of MIMO multi user systems.

TOTAL:45 PERIODS

OUTCOMES

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

- Comprehend and appreciate the significance and role of this course in the present contemporary world.
- Analyze Multiuser Systems, CDMA, WCDMA network planning and OFDM Concepts.
- Apply the knowledge about the importance of MIMO in today's communication.
- Appreciate the various methods for improving the data rate of wireless communication system.
- Summarize the principles and applications of wireless systems and standards

TEXT BOOKS

1. Mohinder Jankiraman, "Space-time codes and MIMO systems", Artech House, Boston, London . www.artech house.com, 2004.
2. Paulraj Rohit Nabar, Dhananjay Gore, Introduction of space time wireless communication systems, Cambridge University Press, 2003.

REFERENCES

1. David Tse and Pramod Viswanath,"Fundamentals of Wireless Communication", Cambridge University Press, 2005.
2. Sergio Verdu , "Multi User Detection" Cambridge University Press, 1998.

E-RESOURCES

1. https://nptel.ac.in/courses/117/104/117104099/ (Advanced 3G And 4G Wireless Communication).
2. https://nptel.ac.in/content/storage2/courses/downloads_new/108102117/noc18_ee39_Assignment11.pdf (Information Theory, Coding and Cryptography).

19ECOX03 **COGNITIVE RADIO** **L T P C**
3 0 0 3

OBJECTIVES

The enable students to:

- Understand the evolving software defined radio and cognitive radio techniques and their essential functionalities.
- Study the basic architecture and standard for cognitive radio.
- Understand the physical, MAC and Network layer design of cognitive radio.
- Expose the student to evolving applications and advanced features of cognitive radio.
- Learn the design of the wireless networks based on the cognitive radios.

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 LicensedSpectrum 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 layerdesign - routing in cognitive radios, flow control and error control techniques.

UNIT V: ADVANCED TOPICS IN COGNITIVE ROAD 9

Overview of security issues in cognitive radios, auction based spectrum markets in cognitiveradio networks, public safety and cognitive radio, cognitive radio for Internet of Things.

TOTAL: 45 PERIODS

OUTCOMES

- Upon completion of the course, the students will be able to:
- Gain knowledge on the design principles on software defined radio and cognitive radio.
- Develop the ability to design and implement algorithms for cognitive radio spectrum sensing and dynamic spectrum access.
- Build experiments and projects with real time wireless applications.
- Apply the knowledge of advanced features of cognitive radio for real world applications.

TEXT BOOKS

1. Alexander M. Wyglinski, MAziar Nekovee, Thomas Hou, "Cognitive Radio Communications and Networks", Academic Press, Elsevier, 2010.
2. Huseyin Arslan (Ed.), "Cognitive Radio, and Adaptive Wireless Systems", Springer, 2007.

REFERENCES

1. Bruce Fette, "Cognitive Radio Technology", Newnes, 2006.
2. Kwang-Cheng Chen, Ramjee Prasad, " Cognitive Radio Networks", John Wiley and Sons, 2009.

E-RESOURCES

1. https://nptel.ac.in/courses/108/107/108107107/ (Basics Of Software Defined Radios And Practical Applications)
2. https://nptel.ac.in/courses/109/104/109104126/ (Introduction To Advanced Cognitive Processes)

19ECOX04 ELECTRONIC PACKAGING AND TESTING L T P C
3 0 0 3

OBJECTIVES

To enable students to:

- Introduce the various electronic packaging methods.
- Discuss various issues related to the system packaging.
- Learn the Design of PCBs which minimize the EMI and operate at higher frequency.
- Understand the basics of testing and testing equipments.
- Understand the various testing methods.

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, Materials 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, materials processes, properties, characteristics, trends. Multi chip packaging: types, design, comparison, trends. Systems - in - package (SIP); Passives: discrete, integrated, and embedded.

UNIT IV: PCB, SURFACE MOUNT TECHNOLOGY AND THERMAL CONSIDERATIONS 9

Printed Circuit Board: Anatomy, CAD tools PCB design, Standard fabrication, Micro via Boards. Board Assembly: Surface Mount Technology, ThroughHole Technology, Process Control and Design challenges. Thermal Management, Heat Transfer Fundamentals, Thermal conductivityand 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

OUTCOMES

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

- Give a comprehensive introduction to the various packaging types used along with theassociated thermal, speed, signal and integrity power issues.
- Enable design of packages which can withstand higher temperature, vibrations and shock.
- Design of PCBs which minimize the EMI and operate at higher frequency.
- Analyze the concepts of Testing and testing methods.
- Design the different testing schemes for a circuit.

TEXT BOOKS

1. Tummala, Rao., Fundamentals of Microsystems Packaging, McGraw Hill, 2001.
2. R.S.Khandpur, Printed Circuit Board, Tata McGraw Hill, 2005

REFERENCES

1. Blackwell(Ed), The electronic packaging handbook, CRC Press, 2000.
2. Michael L. Bushnell & Vishwani D. Agarwal," Essentials of Electronic Testing for Digital, memory & Mixed Signal VLSI Circuits", Kluwer Academic Publishers 2000.

E-RESOURCES

1. https://nptel.ac.in/courses/112/105/112105267/ (Electronic Packaging And Manufacturing).
2. https://nptel.ac.in/courses/108/108/108108031/ (An Introduction To Electronic System Packing).

19ECOX05 **LOW POWER SoC DESIGN** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- Identify sources of power in an IC.
- Understand basic principles of System on Chip Design.
- Learn optimization of power in combination and sequential logic machines for SoC Design.
- Identify suitable Techniques to reduce the power dissipation and design circuits with low power dissipation.
- Discuss the different methods of floor planning.

UNIT I: POWER CONSUMPTION IN CMOS **9**

Physics of power dissipation in CMOS FET devices - Hierarchy of limits of power - Sources of power consumption - Static Power Dissipation, Active Power Dissipation - Designing for Low Power, Circuit Techniques for Leakage Power Reduction - Basic principle of low power design, Logic level power optimization - Circuit level low power design.

UNIT II: SYSTEM-ON-CHIP DESIGN **9**

System-on-Chip Concept, Design Principles in SoC Architecture, SoC Design Flow, Platform based and IP based SoC Designs, Basic Concepts of Bus-Based Communication Architectures. High performance algorithms for ASICs/ SoCs as case studies - Canonic Signed Digit Arithmetic, KCM, Distributed Arithmetic, High performance digital filters for sigma- delta ADC.

UNIT III: POWER OPTIMIZATION OF COMBINATIONAL AND SEQUENTIAL LOGIC MACHINES FOR SOC **9**

Introduction to Standard Cell-Based Layout - Simulation - Combinational Network Delay - Logic and interconnect Design - Power Optimization - Switch Logic Networks. Introduction - Latches and Flip-Flops - Sequential Systems and Clocking Disciplines - Sequential System Design - Power Optimization - Design Validation - Sequential Testing.

UNIT IV: DESIGN OF LOW POWER CIRCUITS FOR SUB SYSTEM ON A SOC **9**

Subsystem Design Principles - Combinational Shifters - Adders - ALUs - Multipliers - High Density Memory - Field Programmable Gate Arrays - Programmable Logic Arrays - Computer arithmetic techniques for low power system - low voltage low power static Random access and 116 dynamic Random access memories, low power clock, Inter connect and layout design.

UNIT V: FLOOR PLANNING **9**

Floor-planning Methods - Block Placement & Channel Definition - Global Routing - switchbox Routing - Power Distribution - Clock Distributions - Floor - planning Tips - Design Validation - OffChip Connections - Packages, The I/O Architecture - PAD Design.

TOTAL: 45 PERIODS

OUTCOMES

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

- Analyze and design low-power VLSI circuits using different circuit technologies for system on chip design.
- Understand about soc models in computation and co design
- Understand about communication and networking of soc
- Utilize logic simulation methods to design Low Power VLSI circuits.
- Able to carry out research and development in the area of Low Power VLSI circuits.

TEXT BOOKS

1. J.Rabaey, - Low Power Design Essentials (Integrated Circuits and Systems) ǁ,Springer, 2009.
2. Wayne Wolf, - Modern VLSI Design - System - on - Chip Designǁ, Prentice Hall, 3rd Edition, 2008.

REFERENCES

1. J.B.Kuo & J.H.Lou, - Low-voltage CMOS VLSI Circuitsǁ, Wiley, 1999.
2. A.Bellaowar & M.I.Elmasry,ǁLow power Digital VLSI Design, Circuits and Systemsǁ,Kluwer, 1996.

E-RESOURCES

1. https://nptel.ac.in/courses/106/105/106105034/ (Low Power VLSI Circuits And Systems)
2. https://nptel.ac.in/courses/106/105/106105161/ (VLSI Physical Design)

OPEN ELECTIVE – II

19ECOX06 **PHOTONIC NETWORKS** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- Understand the importance of the backbone infrastructure for our present technology.
- Expose Future communication needs and familiarize them with the architectures.
- Understand the differences in the design of data plane and the control plane and the routing, switching the network management and protection methods.
- Study concept of optical network architectures.
- Expose 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

OUTCOMES

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

- Use the backbone infrastructure for our present and future communication needs.
- Analyze the architectures and the protocol stack.
- Compare the differences in the design of data plane, control plane.
- Understand the network design concept .
- Implement the packet switching and optical networks.

TEXT BOOKS

1. Rajiv Ramaswami and Kumar N. Sivarajan, "Optical Networks: A Practical Perspective, Harcourt Asia Pte Ltd", 2nd Edition 2004.
2. Siva Ram Moorthy and Mohan Gurusamy, "WDM Optical Networks: Concept, Design and Algorithms", Prentice Hall of India, Ist Edition, 2002.

REFERENCES

1. P.E. Green, Jr., "Fiber Optic Networks", Prentice Hall, NJ, 1993.
2. Biswanath Mukherjee, "Optical WDM Networks", Springer Series, 2006.

E-RESOURCES

1. https://nptel.ac.in/courses/117/101/117101054/ (Optical Communication).
2. https://nptel.ac.in/content/storage2/courses/117101054/downloads/lect20.pdf (WDM Networks).

19ECOX07 **VIDEO ANALYTICS** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- Acquire the knowledge of extracting information from surveillance videos.
- Basic Knowledge about hardware video equipments.
- Learn Event Modeling for different applications.
- Understand the models and techniques used for recognition of objects in videos.
- Enhancement different technology of video technology.

UNIT I: DIGITAL VIDEO HARDWARE **9**

Worldwide Video Standards (NTSC, PAL, SECAM) - Interlaced and Progressive Scan - Resolution - Color models in video - YUV, YIQ, YCbCr - Types of CCTV (closed circuit television) camera - PTZ (pan - tilt zoom) camera - IR (Infrared) camera - IP (Internet Protocal) camera - wireless security camera - Multiple view geometry - camera network calibration - PTZ camera calibration - camera placement - smart imagers and smart cameras.

UNIT II: CLASSIFIERS **9**

Neural networks (back propagation) - Deep learning networks- Fuzzy Classifier- Bayesian classifier- HMM based class.

UNIT III: FOREGROUND EXTRACTION **9**

Background estimation- Averaging- Gaussian Mixture Model- Optical Flow based- Image Segmentation- Region growing- Region splitting-Morphological operations- erosion-DilationTracking in a multiple camera environment.

UNIT IV: HUMAN FACE RECOGNITION AND GAIT ANALYSIS **9**

Template based activity recognition - Human Recognition using Face - Human Recognition Using Gait - HMM Framework for Gait Recognition - Description based approaches - Humaninteractions - group activities - Applications and challenges.

UNIT V: VIDEO ANALYTICS FOR BUSINESS INTELLIGENCE AND TRAFFIC MONITIRING AND ASSISTANCE **9**

Customer behavior analysis - people counting- Traffic rule violation detection- traffic congestion identification for route planning- driver assistance- lane change warning.

TOTAL: 45 PERIODS

OUTCOMES

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

- Apply adaptive background modeling and video tracking algorithms for intelligent surveillance applications.
- Know the concept of classifiers and its types.
- Model a framework for Human activity recognition.
- Apply mathematical models and algorithms to real problems in video analysis.
- Apply the concept of traffic monitoring and routing methods.

TEXT BOOKS

1. Graeme A. Jones (Editor), Nikos Paragios (Editor), Carlo S. Regazzoni (Editor) Video-Based Surveillance Systems: Computer Vision and Distributed Processing , Kluwer academic publisher, 2000.
2. Changhong Chen, Jimin Liang, Heng Zhao, Haihong Hu, and JieTian, "Factorial HMM and Parallel HMM for Gait Recognition", IEEE Transactions on Systems, Man, and Cybernetics—Part C: Applications and Reviews, Vol. 39, No. 1, January 2009.

REFERENCES

1. Zhihao Chen (Author), Ye Yang (Author), Jingyu Xue (Author), Liping Ye (Author), Feng Guo (Author), The Next Generation of Video Surveillance and Video Analytics: The Unified Intelligent Video Analytics Suite, CreateSpace Independent Publishing Platform, 2014.
2. Caifeng Shan (Editor), Fatih Porikli (Editor), Tao Xiang (Editor), Shaogang Gong (Editor) Video Analytics for Business Intelligence, Springer, 2012.

E-RESOURCES

1. https://nptel.ac.in/courses/106/108/106108102 (System Analysis and Design)
2. https://nptel.ac.in/courses/109/103/109103142 (Human Behaviour)

19ECOX08 FUNDAMENTALS OF NANO SCIENCE L T P C
3 0 0 3

OBJECTIVES

To enable students to:

- Provide wide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- Educate on the rudiments of Micro fabrication techniques.
- Educate on applications of MEMS.
- Provide wide information dealing with nano material and its necessity.
- Analyze methods involving preparation of nano scale devices.

UNIT I: INTRODUCTION 9

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties.

UNIT II: GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III: NANO MATERIALS 9

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dots- preparation, properties and applications.

UNIT IV: CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques-AFM, SPM, STM, SNOM, ESCA, SIMS-Nano indentation.

UNIT V: APPLICATIONS 9

Introduction, materials used and applications in renewable energy generation, drug delivery,

cosmetics, tissue engineering, bioinformatics, information technology, agriculture & food technology, high integrated circuits, nanomedicine, molecular motors, bioelectronics & spintronics.

TOTAL: 45 PERIODS

OUTCOMES

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

- Will familiarize about the science of nanomaterials
- Analyze the different nano techniques.
- Will demonstrate the preparation of nanomaterials.
- Having an ability to design a component or a product applying all the relevant standards .
- Apply the different materials used in renewable energy generation.

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., Nanomaterials: Synthesis, Properties and Applications, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, Nanoscale Charecterisation of surfaces and Interfaces, 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES

1. Akhlesh Lakhtakia,The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations. Prentice-Hall of India (P) Ltd, New Delhi, 2007 Biswanath Mukherjee, "Optical WDM Networks", Springer Series, 2006.
2. G Timp, Nanotechnology, AIP press/Springer, 1999.

E-RESOURCES

1. https://nptel.ac.in/courses/113/106/113106093 (Nanotechnology Science And Applications- Introduction)
2. https://nptel.ac.in/courses/118/106/118106019 (Fundamentals of Nanotransistors)

19ECOX09 **AUTOMOTIVE INFOTRONICS** **L T P C**
3 0 0 3

OBJECTIVES

To enable students to:

- Understand the basics of Automotive Infotronics & Autotronics.
- Know the working of sensors and actuators used in vehicle control.
- Understand the working of electronic fuel supply and the working electronic steering system.
- Expose the fundamentals in various automotive body construction techniques.
- Understand the computer based automotive instrumentation system.

UNIT I: BASIC OF AUTOTRONICS **9**

Importance of Autotronics-definition of mechatronics- architecture of mechatranics - system-measurement, open loop and closed loop control system. - signal conditioning-interfacing-analog and digital signals- conversion of analog to digital conversion.-difference between conventional and mechatronics system.

UNIT II: TELEMATICS **9**

Global positioning systems, geographical information systems, navigation systems, automotive vision system, road recognition, driver assistance systems.

UNIT III: SAFETY SYSTEMS AND SECURITY SYSTEMS **9**

Airbags, seat belt tightening system, collision warning systems, child lock, anti - lock braking systems. anti - spin regulation, traction control systems. Anti theft technologies, smart card system, number plate coding.

UNIT IV: ADAPTIVE CONTROL SYSTEMS AND COMFORT SYSTEMS **9**

Adaptive cruise control, adaptive noise control, active roll control system, cylinder cut- off technology. Active suspension systems, requirement and characteristics, different types, power steering, collapsible and tilt able steering column, power windows.

UNIT V: SENSORS AND ACTUATORS **9**

Sensors - variable resistance sensor, pickup coil type sensor, Hall Effect switch, piezoelectric knock sensor, throttle position sensor, MAP sensor, MAF sensor and Actuators

TOTAL: 45 PERIODS

OUTCOMES

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

- Understand about different vehicle assistance system.
- Analyze the about safety system about vehicle.
- Apply the Knowledge navigation systems using GPS.
- Understand about different Control Systems.
- Implement different methods in sensor position.

TEXT BOOKS

1. Ljubo Vlacic, Michel Parent and Fumio Harashima, "Intelligent Vehicle Technologies", Butterworth-Heinemann publications, Oxford, 2001.
2. Robert Bosch, "Automotive Hand Book", 5th Edition, SAE, 2000.

REFERENCES

1. Bechhold, "Understanding Automotive Electronics", SAE, 1998.
2. Ronald K Jurgen, "Navigation and Intelligent Transportation Systems - Progress inTechnology", Automotive Electronics Series, SAE, USA, 1998.

E-RESOURCES

1. https://nptel.ac.in/courses/107/106/107106088/(Fundamental of Automotive systems)
2. https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-de06 / (introduction to machine learning)

19ECOX10 TELECOMMUNICATION SWITCHING NETWORKS L T P C
3 0 0 3

OBJECTIVES

To enable students to,

- Introduce the concepts of Frequency and Time division multiplexing
- Introduce a mathematical model for the analysis of telecommunication traffic.
- Introduce the need for network synchronization and study synchronization issues.
- Study the enhanced local loop systems in digital environment.
- Introduce ISDN, DSL / ADSL, and fiber optic systems in subscriber loop.

UNIT I: MULTIPLEXING 9

Transmission Systems, FDM Multiplexing and modulation, Time Division Multiplexing, Digital Transmission and Multiplexing: Pulse Transmission, Line Coding, Binary N-Zero Substitution, Digital Biphase, Differential Encoding, Time Division Multiplexing, Time Division Multiplex Loops and Rings.SONET/SDH: SONET Multiplexing Overview, SONET Frame Formats, SONET Operations, Administration and Maintenance, Payload Framing and Frequency Justification, Virtual Tributaries, DS3 Payload Mapping, E4 Payload Mapping, SONET Optical Standards, SONET Networks. SONET Rings: Unidirectional Path-Switched Ring, Bidirectional Line-Switched Ring.

UNIT II: DIGITAL SWITCHING 9

Switching Functions, Space Division Switching, Time Division Switching, two-dimensional switching: STS Switching, TST Switching, No.4 ESS Toll Switch, Digital Cross-Connect Systems, Digital Switching in an Analog Environment. Elements of SSN07 signaling.

UNIT III: NETWORK SYNCHRONIZATION CONTROL AND MANAGEMENT 9

Timing: Timing Recovery: Phase-Locked Loop, Clock Instability, Jitter Measurements, Systematic Jitter. Timing Inaccuracies: Slips, Asynchronous Multiplexing, Network Synchronization, U.S. Network Synchronization, Network Control, Network Management.

UNIT IV: DIGITAL SUBSCRIBER ACCESS 9

ISDN: ISDN Basic Rate Access Architecture, ISDN U Interface, ISDN D Channel Protocol. High-Data-Rate Digital Subscriber Loops: Asymmetric Digital Subscriber Line, VDSL. Digital Loop Carrier Systems: Universal Digital Loop Carrier Systems, Integrated Digital Loop Carrier Systems, Next-Generation Digital Loop Carrier, Fiber in the Loop, Hybrid Fiber Coax Systems,

Voice band Modems: PCM Modems, Local Microwave Distribution Service, Digital Satellite Services.

UNIT V: TRAFFIC ANALYSIS **9**

Traffic Characterization: Arrival Distributions, Holding Time Distributions, Loss Systems, Network Blocking Probabilities: End-to-End Blocking Probabilities, Overflow Traffic, Delay Systems: Exponential service Times, Constant Service Times, Finite Queues.

TOTAL: 45 PERIODS

OUTCOMES

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

- Describe and apply fundamentals of telecommunication systems and associated technologies.
- Compare and analyze Line coding techniques and examine its error performance
- Analyze basic telecommunication traffic theory.
- Apply the principles of queuing theory in evaluating the performance of congested telecommunication networks.
- Solve problems and design simple systems related to tele-traffic and trunking efficiency

TEXT BOOKS

1. Bellamy John, "Digital Telephony", John Wily & Sons, Inc. 3rd edn. 2000.
2. E. Keiser & E. Strange, Digital Telephony and Network Integration, (2/e), Van Nostrand, 1995.

REFERENCES

1. Thiagarajan Viswanathan, Telecommunication Switching Systems and Networks, PHI, 2006.
2. J.E. Flood, Telecommunications Switching, Traffic and Networks, Prentice Hall, 2012.

E-RESOURCES

1. https://nptel.ac.in/courses/117/104/117104128/(Digital Switching)
2. https://nptel.ac.in/courses/117/104/117104104/(Digital Switching)