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FOREWORD

The greatest contributions to the society by advancements in electronics are affordable means of communication, precise medical diagnostics, navigation, control and automation and so on. These developments have revolutionized the way people live and the way people think. They have not only connected people but also 'things'. These new developments are both exciting and challenging for youngsters who are aspiring for career in Electronics and Communication Engineering.

B. Tech. programme of Electronics and Communication is aimed at offering the knowledge and skills of Electronics and Communication fields – to design, and verify various digital systems, communication systems, automated systems, and networking systems. R16 curriculum includes skill-oriented activities to enable the students to acquire hands-on experience of technology to make them industry ready.

R16 curriculum comprises of:

- *Four elective streams of current technologies*
- *Two modular courses with industry support.*
- *Advanced courses like AD-HOC Sensor networks, High Speed Networks, Robotics and Automation, etc.*
- *Laboratory sessions to as many courses as possible.*

In R16 curriculum, every care has been taken to accommodate the knowledge and skill requirements of industry through proper activities for practice. While making the graduates work ready, it also enables them to be successful in competetive examanitations like GATE and Engineering Services.

The Board of Studies of ECE consists of eminent personalities from industry and research organizations, in addition to experienced faculty members of the university.

External BoS Members:

1. Dr. N. V. S. Narasimha Sarma, *Professor and Dean, NIT Warangal.*
2. Dr. S. Salivahanan, *Principal, SSN College of Engineering, Chennai.*
3. Sri. S. Uma Mahesh, *CEO, INDRION Technologies, Bangalore.*
4. Sri. G. Prudhviraj, *Firmware Engineer, Sandisk, Bangalore.*
5. Sri. P. Hari Babu, *Scientist, CDAC, Bangalore*

I thank all the BOS Members, Academic Council Members and University authorities for encouraging us to design this innovative curriculum for our students. Our special thanks are due to the following individuals from our partner industries and our alumni.

1. Sri. D. Ramakrishna, *Managing Director, Efftronics Ltd., Vijayawada.*
2. Sri. M. Srinivasarao, *Sr. Vice-President, IcommTele, Hyderabad.*
3. Dr. K. Subbarangaiah, *Director, Veda IIT., Hyderabad.*
4. Sri. Ramesh Naidu, *Zonal Manager, Xilinx, Bangalore.*
5. Sri. Visweswaran Jagadeesan, *Sr. Academic Consultant, National Instruments.*
6. Sri. Kumar Sundareshan, *Manager, Biomedical Applications, TMI Systems.*

Dr. N. Usha Rani
HOD, ECE

VISION

To evolve into a Centre of Excellence in Science & Technology through creative and innovative practices in teaching – learning, towards promoting academic achievement and research excellence to produce internationally accepted, competitive and world class professionals who are psychologically strong & emotionally balanced, imbued with social consciousness & ethical values.

MISSION

To provide high quality academic programmes, training activities, research facilities and opportunities supported by continuous industry - institute interaction aimed at promoting employability, entrepreneurship, leadership and research aptitude among students and contribute to the economic and technologicaldevelopment of the region, state and nation.

B.Tech. - ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

To emerge as a Centre of Academic Excellence in Electronics and Communication Engineering that imparts quality technical education, research impetus, professional and ethical values to meet global needs of Industry and society.

MISSION

M 1: Offering state of the art curriculum with innovative practices in teaching learning to pursue career in electronics and related fields.

M 2: Providing advanced laboratory facilities and conducive research environment to make them industry ready and equip to carryout higher education towards research and consultancy.

M 3: Transforming into responsible professionals with leadership qualities, managerial ability, team spirit, social consciousness, human values and ethics.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

Program Educational Objectives (PEOs) are established through a consultation process. PEOs are broad statements that describe the career and professional accomplishments that the graduates should achieve within three to five years after their graduation.

Graduates of the UG-ECE program will be able to

PEO 1: Apply the concepts of electronics, communication and computation to pursue career in core and allied industries to solve industrial and societal problems.

PEO 2: Pursue higher education to progress professionally in contemporary Technologies and multidisciplinary fields with an inclination towards continuous learning.

PEO 3: Exhibit professional skills, ethical values, interpersonal skills, leadership abilities, team spirit and lifelong learning.

B.Tech. - ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAM SPECIFIC OUTCOMES (PSOs)

The students will be able to –

1. Analyse and design electronic systems for signal processing, communications and other applications.
2. Develop Solutions for various problems using Embedded Systems and Internet of Things.
3. Apply domain specific knowledge to design, analyse, synthesize and validate the VLSI systems.

PROGRAM OUTCOMES (POs)

1. **Engineering knowledge: Apply** the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering pr

   oblems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

B.Tech.
ECE
I YEAR

R-16 CURRICULUM

(Applicable for students admitted into First Year from academic year 2016-17 onwards)

I Year I Semester

Course Code	Course Title	L	T	P	C
16HS103	Engineering Mathematics-I	3	1	2	5
16HS102	Engineering Physics	3	-	-	3
16HS105	Technical English Communication	3	-	2	4
16CS101	Basics of Computers and Internet	3	-	2	4
16CS102	Computer Programming	3	1	2	5
16EE101	Basics of Engineering Products	3	-	2	4
16HS104	English Proficiency and Communication Skills	-	-	2	1
16HS110	Engineering Physics Laboratory	-	-	3	2
	Total	**18**	**2**	**15**	**28**

I Year II Semester

Course Code	Course Title	L	T	P	C
16HS108	Engineering Mathematics-II	3	1	2	5
16HS107	Engineering Chemistry	3	-	-	3
16ME101	Engineering Graphics	1	-	3	3
16EE102	Basics of Electrical and Electronics Engineering	3	-	2	4
16HS111	Engineering Chemistry Laboratory	-	-	3	2
16HS109	Environmental Science and Technology	2	-	-	2
16CS202	Data Structures	3	-	2	4
16ME103	Work shop Practice	-	-	3	2
	Total	**15**	**1**	**15**	**25**

L : Lecture Hours/week ; T : Tutorial Hours/week ;
P : Practical Hours/week ; C : Credits of the Course ;

B.Tech.
ECE
II YEAR

R-16 CURRICULUM

(Applicable for students admitted into First Year from academic year 2016-17 onwards)

II Year I Semester

Course Code	Course Title	L	T	P	C
16HS201	Complex Variables and Transformations	3	1	-	4
16EC201	Materials for Electronics Engineering	3	-	-	3
16EC202	Electronic Devices and Circuits	3	-	2	4
16EC203	Network Theory	3	1	-	4
16EC204	Signals and Systems	3	-	2	4
16EC205	Digital Electronics	3	-	2	4
	Employability and Life Skills Elective*	-	-	-	1-3
	Total	**18**	**2**	**6**	**24-26**

* Courses and Programmes such as Foreign Languages, Summer Internship, NCC, NSS, Yoga, Music, Dance, Value Added Courses etc. for which credits and other details shall be defined by concerned coordinators.

II Year II Semester

Course Code	Course Title	L	T	P	C
16EC206	Probability Theory and Stochastic Processes	3	1	-	4
16EC207	Electronic Circuit Analysis	3	-	2	4
16EC208	Analog Communications	3	-	2	4
16EC209	Linear Control Systems	3	-	-	3
16EL102	Soft Skills Laboratory`	-	-	2	1
	Department Elective	-	-	-	3-4
	Department / Open Elective	-	-	-	3-4
	Employability and Life Skills Elective*	-	-	-	1-3
	Total	**12**	**1**	**6**	**23-27**

B.Tech.
ECE
III YEAR

R-16 CURRICULUM

(Applicable for students admitted into First Year from academic year 2016-17 onwards)

III Year I Semester

Course Code	Course Title	L	T	P	C
16EC301	Linear IC's and Applications	3	-	2	4
16EC302	Microprocessors and Microcontrollers	3	-	2	4
16EC303	Digital Communications	3	-	2	4
16EC304	Electromagnetic Waves and Transmission Lines	3	1	-	4
16EL103	Professional Communication Lab	-	-	2	1
	Department Elective	-	-	-	3-4
	Department / Open Elective	-	-	-	3-4
	Employability and Life Skills Elective*	-	-	-	1-3
	Total	**12**	**1**	**8**	**24-28**

III Year II Semester

Course Code	Course Title	L	T	P	C
16HS301	Professional Ethics	2	-	-	2
16EC305	Computer Architecture and Organization	3	-	-	3
16EC306	VLSI Design	3	-	2	4
16EC307	Antenna Propagation	3	1	-	4
16EC308	Digital Signal Processing	3	-	2	4
	Department Elective	-	-	-	3-4
	Department / Open Elective	-	-	-	3-4
	Employability and Life Skills Elective*	-	-	-	1-3
	Total	**14**	**1**	**4**	**24-28**

B.Tech.
ECE
IV YEAR

R-16 CURRICULUM

(Applicable for students admitted into First Year from academic year 2016-17 onwards)

IV Year I Semester

Course Code	Course Title	L	T	P	C
16MS201	Management Science	3	-	-	3
16EC401	Optical Communications	3	-	-	3
16EC402	Microwave and Radar Engineering	3	-	2	4
16EC403	Electronic Instrumentation	3	-	2	4
16CS306	Computer Networks	3	-	2	4
	Department Elective	-	-	-	3-4
	Department / Open Elective	-	-	-	3-4
	Employability and Life Skills Elective*	-	-	-	1-3
	Total	**15**	**-**	**6**	**25-29**

IV Year II Semester

Course Code	Course Title	L	T	P	C
16EC411/16EC412	Project work / Internship	-	-	30	15
	Total	**-**	**-**	**30**	**15**

In addition to L, T, P, C the following information in hours/semester is also provided for each course.

WA/RA : Writing Assignment / Reading Assignment
SSH/HSH : Self Study Hours / Home Study Hours
CS : Case Study and Example
SA : Skills Activity
S : Seminar
BS : Beyond Syllabus

B.Tech.
ECE
ELECTIVES

R-16 CURRICULUM

(Applicable for students admitted into First Year from academic year 2016-17 onwards)

DEPARTMENT ELECTIVE STREAMS AND COURSES

STREAM - 1: VLSI

Course Code	Course Title	L	T	P	C
16EC250	Digital System Design using HDL	3	-	2	4
16EC350	Perl and Python	3	-	-	3
16EC351	System on Chip Design	3	-	-	3
16EC450	Hardware Verification Techniques	3	-	-	3
16EC451	Testing of VLSI Circuits	3	-	-	3
16EC452	Nano Electronics	3	-	-	3

STREAM - 2: COMMUNICATION SYSTEMS

Course Code	Course Title	L	T	P	C
16EC260	Television Engineering	3	-	-	3
16EC360	Cellular and Mobile Communications	3	-	-	3
16EC460	Satellite Communications	3	-	-	3
16EC461	Digital Image Processing	3	-	2	4

STREAM - 3: EMBEDDED SYSTEMS AND NETWORKING

Course Code	Course Title	L	T	P	C
16EC270	Embedded Linux	3	1	-	4
16EC370	Microcontrollers for Embedded Systems	3	-	-	3
16EC371	Adhoc and Sensor Networks	3	-	-	3
16EC470	High Speed Networks	3	-	-	3

B.Tech.
ECE
ELECTIVES

R-16 CURRICULUM

(Applicable for students admitted into First Year from academic year 2016-17 onwards)

DEPARTMENT ELECTIVE STREAMS AND COURSES

INDIVIDUAL ELECTIVE COURSES

Course Code	Course Title	L	T	P	C
16CS307	Operating Systems	3	-	2	4
16EC380	Unix and Shell Programming	3	-	-	3
16EC480	DSP Architectures and Programming	3	-	2	4
16EC481	Robotics and Automation	3	-	-	3
16CS457	Internet of Things	3	1	-	4
16EC482	MEMS and NEMS	3	-	-	3

MODULAR COURSES

Course Code	Course Title	L	T	P	C
16EC490	Thermal Management of Electronics Systems	2	-	-	2
16EC491	Introduction to Switch Mode Power Converters	2	-	-	2

B.Tech.
ECE
OPEN ELECTIVES

R-16 CURRICULUM

(Applicable for students admitted into First Year from academic year 2016-17 onwards)

OPEN ELECTIVE STREAMS AND COURSES

A) MINOR STREAMS:

MANAGEMENT STREAM

Course Code	Course Title	L	T	P	C
16MS202	Principles and Practice of Management	3	-	-	3
16MS301	Managerical Economics	3	-	-	3
16MS302	Finance for Engineers	3	-	-	3
16MS401	Engineering Entrepreneurship	3	-	-	3

HUMANITIES STREAM

Course Code	Course Title	L	T	P	C
16HS219	Indian History and Culture	3	-	-	3
16HS224	Polity and Governance of India	3	-	-	3
16HS307	Economic and Social Development of India	3	-	-	3
16HS308	Geography and Environmental Concerns of India	3	-	-	3

IT STREAM

Course Code	Course Title	L	T	P	C
16IT201	Object oriented Programming	3	-	2	4
16CS303	Web Technologies	3	1	2	5
16CS254	Scripting Languages	3	-	2	4
16CS201	Database Management Systems	3	1	2	5
16IT309	Unix Programming	3	1	-	4
16CS301	Software Engineering	3	-	2	4
16CS302	Data Mining Techniques	3	-	2	4
16IT409	Multimedia Systems	3	-	2	4

B) OPEN STREAMS OF OTHER DEPARTMENTS

Elective Streams offered by other departments that are opted by the students are included in this category.

C) INDIVIDUAL ELECTIVE COURSES OF OTHER DEPARTMENTS

Individual elective courses of other departments that are opted by the students are included in this category.

I

YEAR

ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.

I SEMESTER

- 16HS103 - Engineering Mathematics - I
- 16HS102 - Engineering Physics
- 16HS105 - Technical English Communication
- 16CS101 - Basics of Computers and Internet
- 16CS102 - Computer Programming
- 16EE101 - Basics of Engineering Products
- 16HS104 - English Proficiency and Communication Skills
- 16HS110 - Engineering Physics Laboratory

II SEMESTER

- 16HS108 - Engineering Mathematics - II
- 16HS107 - Engineering Chemistry
- 16ME101 - Engineering Graphics
- 16EE102 - Basics of Electrical and Electronics Engg.
- 16HS111 - Engineering Chemistry Laboratory
- 16HS109 - Environmental Science and Technology
- 16CS202 - Data Structures
- 16ME103 - Workshop Practice

COURSE CONTENTS

I SEM & II SEM

16HS103 ENGINEERING MATHEMATICS - I

Hours Per Week :

L	T	P	C
3	1	2	5

Course Description and Objectives:

It is aimed to offer various analytical as well as numerical methods to solve first and second order ordinary differential equations; to impart the knowledge of partial differentiation; to acquaint with the various methods to solve first and second order partial differential equations; to make the student familiar with applications of first order ordinary differential equations. To make the student to use different mathematical tools of MATLAB related to above concepts.

Course Outcomes:

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

CO1: Recognise and solve different types of first and 2nd order ordinary differential equations.

CO2: Understand the process of evaluation ODE numerically.

CO3: Illustrate the Application of partial differentiation.

CO4: Classify and solve the linear and non-linear partial differential equations.

CO5: Apply software tools to obtain and verify the solutions.

SKILLS:

- ✓ *Solve given differential equation by suitable method.*
- ✓ *Compute numerical solutions of differential equation by apt method.*
- ✓ *Compute maxima/minima of given function.*
- ✓ *Solve given partial differential equation by appropriate method.*

ACTIVITIES:

- *Differentiate methods to solve given differential equation.*
- *Compute numerical solutions to differential equation and compare the result with MATLAB output.*
- *Compute maxima/minima of given function.*
- *Differentiate methods to solve given partial differential equation.*
- *Estimation of acoustic impedance of a given material.*

UNIT - 1 **L- 9, T-3**

FIRST ORDER DIFFERENTIAL EQUATIONS: Variable separable, Homogeneous differential equations, Linear differential equations, Bernoulli's differential equations, Exact and non-exact differential equations.

UNIT - 2 **L- 9, T-3**

SECOND ORDER DIFFERENTIAL EQUATIONS: Linear differential equations with constant coefficients, Homogeneous differential equations of second and higher order, Methods to find particular integral when RHS is of the form - e^{ax}, sinax, cosax and x^n.

UNIT - 3 **L- 9, T-3**

APPLICATIONS OF FIRST ORDER DIFFERENTIAL EQUATIONS: Orthogonal trajectories (including polar form), Newton's law of cooling, Law of natural growth and decay.

NUMERICAL METHODS TO SOLVE DIFFERENTIAL EQUATIONS: Taylor series method, Picard's method, Euler's and modified Euler's method, Runge-Kutta method.

UNIT - 4 **L- 9, T-3**

MAXIMA/MINIMA OF FUNCTIONS OF TWO VARIABLES: Review of partial differentiation - Partial derivatives, Partial derivatives of higher order; Homogeneous function, Euler's theorem, Total differential coefficient, Maxima and Minima of a function of two variables, Conditions for extreme values, Lagrange method of undetermined multipliers.

JACOBIANS : Definition, Properties, Jacobian of implicit functions.

UNIT - 5 **L- 9, T-3**

PARTIAL DIFFERENTIAL EQUATIONS: Formation of partial differential equations, Linear (Lagrange) equations, Method of multipliers, Non-linear partial differential equations (Types), Charpit's method, Second order linear equations with constant coefficients only, Classifications, Rules to find complimentary function and particular integral (special cases).

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS Total hours-30

1. Basic mathematical operations using MATLAB.
2. Solving simple expressions.
3. Limits.
4. Continuity.
5. Symbolic differentiation.
6. Symbolic integration.
7. Plotting of curves.
8. Plotting of surfaces.
9. Maxima & minima of functions of one variable.
10. Maxima & minima of functions of two variable.
11. Solving first order O.D.E.
12. Euler's Method and R-K Method.

TEXT BOOKS:

1. H. K. Dass and Er. Rajanish Verma, "Higher Engineering Mathematics", 3rd edition, S. Chand & Co, 2014.
2. B. S. Grewal, "Higher Engineering Mathematics", 44th edition, Khanna Publishers, 2014.
3. Rudra Pratap, "Getting started with MATLAB", Oxford University Publication, 2009.

REFERENCE BOOKS:

1. Srimanta Pal and Subodh C. Bhunia, "Engineering Mathematics", Oxford Publications, 2015.
2. B. V. Ramana, "Advanced Engineering Mathematics", McGraw Hill education, 25th reprint, 2015.

16HS102 ENGINEERING PHYSICS

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

Technology is the experimental information for the physicist, where the theories can be tested. Recent technical developments have been the results of collaboration of physicists and engineers.

Study of engineering physics is a unique opportunity to learn the fundamental concepts of physics and apply this knowledge to both scientific and engineering problems.

The present course deals with various fields such as Lasers, Optical fibers, Photonics, Nano and functional materials, make the students to enrich basic knowledge in various fields of physics and apply the same in engineering fields.

Course Outcomes:

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

CO1: Recognize the relevant applications of Ultrasonic waves by the grasp over their production and properties.

CO2: Analyze the characteristics of Laser for suitable applications in the field of industry, medicine and communication and to foster the knowledge on optical fibers to realize fiber optic communication and fiber optic sensors.

CO3: Apply the principles of quantum mechanics to learn the dynamics of free electrons in metals.

CO4: Evaluate efficiency of Solar cell and to understand the functioning of Photonic devices.

CO5: Demonstrate the knowledge on fabrication and applications of Nano-materials and latest advanced materials.

SKILLS:

- ✓ *Determine the velocity of ultrasonics in a given liquid using interferometer.*
- ✓ *Study the wavelengths of light sources and lasers.*
- ✓ *Estimate the efficiency of a given solar cell.*
- ✓ *Learn about the type of the optical fiber and its ability to propagate light waves from its numerical aperture.*
- ✓ *Know voltage – current characteristics of a given light emitting diode.*

UNIT - 1 **L-9**

ULTRASONICS: Introduction, Production of ultrasonic waves - Piezoelectric method; Properties of ultrasonic waves, Types of ultrasonic waves, Determination of velocity of ultrasonic waves in solids and liquids, SONAR - Medical applications.

NON-DESTRUCTIVE TESTING: Introduction, Types, Visual inspection, Liquid penetrate testing, Ultrasonic Testing Systems, X - Ray radiography.

UNIT - 2 **L-9**

LASERS: Characteristics of laser light, Spontaneous and Stimulated emission of radiation, He-Ne laser, CO_2 laser, Semiconductor laser, Applications.

HOLOGRAPHY: Holography and applications.

FIBER OPTICS: Principle of optical fiber, Acceptance angle, Numerical aperture, Types of fibers, Dispersion and attenuation in optical fibers, Optical fiber communication system, Fiber optic sensors.

UNIT - 3 **L-9**

QUANTUM MECHANICS: Introduction, Matter waves, Schroedinger's time independent wave equation, Physical significance of the wave function, Particle in one dimensional potential well, Tunneling phenomenon.

FREE ELECTRON THEORY OF METALS: Introduction, Classical free electron theory, Electrical conductivity of metal, Quantum free electron theory, Fermi - Dirac distribution function and its variation with temperature.

PARTICLE ACCELERATORS: Introduction, Cyclotron, Synchrocyclotron, Betatron and applications.

UNIT - 4 **L-9**

SOLAR ENERGY: Solar radiation, Photovoltaic effect, Solar cells, Efficiency of solar cell, Solar thermal energy conversion systems.

PHOTONICS: LED, LCD, Photo conducting materials, Photo detectors, Photonic crystals, Non- linear optical behaviour of materials, Applications.

UNIT - 5 **L-9**

NANO MATERIALS: Introduction, Fabrication of nano materials - Ball milling - Sol-Gel method; Physical and chemical properties of nano materials, Applications.

FUNCTIONAL MATERIALS: Smart materials, Shape memory alloys, Chromic materials (Thermo, Photo and electro), Metallic glasses, Advanced ceramics, Composites, Fiber reinforced plastics/metals, Biomaterials.

TEXT BOOKS:

1. V.Rajendran, "Engineering Physics", 7th edition, McGraw Hill Education (India) Pvt.Ltd., 2014.
2. D.K. Bhattacharya and Poonam Tandon, "Engineering Physics", Oxford University Press, 2015.

REFERENCE BOOKS :

1. M.R. Srinivasan, "Engineering Physics", 1st edition, New Age International Publishers, 2008.
2. M.N. Avadhanulu & P.G. Kshirsagar, "Engineering Physics", 1st edition, Chand and Company Ltd., 1992.
3. Sukhatme S.P., "Solar Energy", 2nd edition, TMH publication, 2005.
4. Dr. Arumugam "Materials Science", 3rd edition, Anuradha Publications, 2002.

ACTIVITIES:

- *Estimation of acoustic impedance of a given material.*
- *Measurement of distances using ultrasonic range finder.*
- *Study of linear density of yarn/ fibre using Melde's experiment.*
- *Determination of refractive index of a given liquid using laser.*
- *Find the height of a room using laser.*
- *Identify the type of semi-conductor using Hall effect.*
- *Study of numerical aperture of optical fibres made of different materials.*
- *Design of solar panel to obtain required voltage.*
- *Evaluation of thermal conductivity of materials.*
- *Measure the temperature using thermo couple.*

16HS105 TECHNICAL ENGLISH COMMUNICATION

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives :

To introduce students the specific use of English for the purpose of Technical Communication that would strengthen their skills in the areas of writing and speaking and thereby enable them to function effectively in their professional sphere. The objective of this course is to direct the students towards developing their technical writing skills in particular and overall language proficiency in general. It will be done by making students peruse good samples of technical writing covering a wide range of contemporary issues relevant to the engineering profession. Students will, also be revisiting, the fundamentals of grammar to get trained on use of standard English.

Course Outcomes:

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

CO1: Understand and apply the rules of grammar to speak in technical context.

CO2: Strengthen reading and listening comprehension skills to follow academic discussions in the engineering context.

CO3: Develop appropriate vocabulary for carrying out academic writing tasks.

CO4: Attain adequate proficiency to participate in the classroom discussions and make simple presentations.

CO5: Understand and apply the mechanics of writing to produce simple texts for academic purpose.

SKILLS:

- ✓ *Apply different sub skills like skimming, scanning, reading for information, reading for inference etc to understand different kinds of text.*
- ✓ *Apply different sub skills like top down, bottom up approaches to listening, and understand phonetic and phonological features of the English language to deconstruct long spoken discourses.*
- ✓ *Use functional vocabulary relevant to subject areas like environment, tourism, engineering, technology and media to express ideas lucidly.*
- ✓ *Use appropriate sentence structure, cohesive devices and diction to construct simple text in writing and regular correspondence like e-mails, letters etc.*
- ✓ *Capture and understand key points during class room discourses through applying sub skills of writing like note-making, paraphrasing and summarizing.*

UNIT - 1 **L-9**

- Text : **ENVIRONMENTAL CONSCIOUSNESS**
  (Climate Change, Green Cover, Pollution, Renewable vs. Non renewable energy sources (from Energy Unit)
- Grammar : Articles, Prepositions, Sentence types and construction
- Vocabulary : Root, Prefixes, Suffixes
- Composition : Paragraph writing (Descriptive and narrative)
- Laboratory Practice : Introduction to phonetics
  (Organs of Speech, Consonants, Vowels and Diphthongs, Syllable, Stress and Intonation)

UNIT - 2 **L-9**

- Text : **EMERGING TECHNOLOGIES**
  (Solar power, Cloud computing, Nanotechnology, Wind energy (to be covered from Energy unit))
- Grammar : Time and tense (Present-past-future; Helping verbs, Modals)
- Vocabulary : Synonyms, Antonyms
- Composition : Letter writing (Informal)
- Laboratory Practice : Grammar Practice (Speaking of past, present and future)

UNIT - 3 **L-9**

- Text : **TRAVEL AND TOURISM**
  (Advantages and disadvantages of travel-tourism, Atithi devo bhava, Tourism in India)
- Grammar : Subject-Verb agreement, Sentence construction
- Vocabulary : Idioms and phrases
- Composition : Letter writing (Formal)
- Laboratory Practice : Situational conversations – Role - Plays
  (Introducing, Greeting, Enquiring, Informing, Requesting, Inviting)

UNIT - 4 **L-9**

- Text : **ENGINEERING ETHICS**
  (Challenger disaster, Biotechnology, Genetic engineering, Protection from natural calamities, How pertinent is the nuclear option? An environment of energy (from Energy Unit))
  Avoiding sexist language (Gender Sensitization)
- Grammar : Sentence transformation (Degrees, Voice, Speech and Synthesis)
- Vocabulary : Phrasal verbs
  Composition : Note-making, Text, Nandan Nilekani's In Search of Our Energy Solutions (from Energy Unit)
  Summarizing, Text on "Flight from conversation" (New York Times)
- Laboratory Practice : Situational conversations, Role-Plays (Emotions, Directions, Descriptions, Agreements, Refusals, Suggestions)

ACTIVITIES:

- *Doing phonetic transcription of selected words from the list provided using talking dictionaries of AHD and CALD.*
- *Completing graded grammar exercises in Rosetta Stone.*
- *Completing graded listening and reading comprehension exercises in Rosetta Stone.*
- *Watching TED videos and making notes.*
- *Watching TED videos to paraphrase and summarize.*
- *Ad- making.*
- *Preparing brochure.*
- *Dialogue writing followed by role play.*
- *Poster designing.*
- *Team presentation with PPTs and Group Discussion.*

UNIT - 5 **L-9**

- Text : **MEDIA MATTERS**
  (History of media, Language and media, Milestones in media, Manipulation by Media, Thousands march against nuclear power in Tokyo (from Energy Unit), Entertainment media, Interviews)
- Grammar : Common errors
- Vocabulary : One-word substitutes
- Composition : E-mail – Short message service (SMS), Writing advertisements, Reporting; Social media - Blogging, Facebook, Twitter (acceptable and non acceptable content)
- Laboratory Practice : Group discussions – (Topics from Energy Unit), Dumping of nuclear wastes, Exploration of eco-friendly energy options, Lifting of subsidies on petrol, Diesel, LPG etc)

TEXT BOOK:

1 *"Mindscapes* - English for Technologists and Engineers", Orient Black Swan, 2012.

REFERENCE BOOKS:

1. V. R. Narayana Swamy, "Strengthen Your Writing", 1st edition, Orient Longman, 2003.
2. Thomas Elliott Berry, "The Most Common Mistakes in English Usage", 1st edition, Tata McGraw Hill, 2004.
3. T. Balasubramanian, "A Textbook of English Phonetics for Indian Students", Macmillan Ltd., 2000.
4. Sasikumar.V and P.V. Dhamija,. "Spoken English: A Self-Learning Guide to Conversation Practice", 34th Reprint, Tata McGraw Hill, New Delhi, 1993.
5. Margaret M Maison, "Examine Your English", 1st edition, Orient Longman, 1999.
6. Ashraf Rizwi, "Effective Technical Communication", Tata McGraw Hill, 2005.

16CS101 BASICS OF COMPUTERS AND INTERNET

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course provides students with a working knowledge of the terminology, processes, and components associated with Computers and Internet. Students will get exposure to Building blocks of Computers, Operating Systems, Application software, Networking, Internet, World Wide Web, Security, Maintenance, Information Systems, and the application development processes.

Course Outcomes:

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

CO1: Demonstrate the disassembling and assembling of a personal computer system.

CO2: Install the operating system and other software required in a personal computer system.

CO3: Analyze and visualize the data using various operations in Excel.

CO4: Identify the various threats to users and data.

CO5: Understand the concept of cyber security.

SKILLS:

- ✓ *Assemble and disassemble the personal computer system.*
- ✓ *Install different desktop operating systems.*
- ✓ *Use the basic text processing, simple data analysis and data presentation tools.*
- ✓ *Configure network parameters.*
- ✓ *Secure the personal computer and information from various external threats.*

ACTIVITIES:

- *Prepare a report on various generations of computers and its peripherals.*
- *Disassembling and assembling of a personal computer system.*
- *Install the Linux operating system and other software required in a personal computer system.*
- *Connect the system to an Ethernet and configure the same.*
- *Prepare an MS Word Document.*
- *Prepare a spread sheet with various mathematical operations, charts and sorting etc.*
- *Make a report on power point presentation for the given topic.*

UNIT - 1 **L-10**

COMPUTING SYSTEMS: Introduction to computer, Computers for individuals, Importance of computers, Parts of computer system, Memory devices, Input and output devices, Types of monitors, Types of printers, Number systems, Bits and bytes, Text codes and types of processors.

UNIT - 2 **L-10**

OPERATING SYSTEMS: Types of operating systems, User interfaces, PC operating systems, Network operating systems, Types of software, Programming languages, Compiler and interpreter, Program control flow and algorithm.

UNIT - 3 **L-8**

NETWORKS AND DATABASES: Networking basics, Uses of network, Types of networks, Network hardware, Introduction to data bases and database management systems.

UNIT - 4 **L-8**

INTERNET AND WWW: Internet's services, World wide web, Browser setups, Using search engine, Email and other internet applications.

UNIT - 5 **L-9**

CYBER SECURITY: The need of computer security, Basic security concepts, Threats of users, Online spying tools, Threats to data, Cybercrime, Protective measures.

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

- know the usage of the computer systems.
- setup the IDEs for the computer programming languages.
- get exposure on office automation tools like Microsoft Word, Excel, and power point.
- identify the different computer system and data threats and also protect them by installing antivirus software.

LIST OF EXPERIMENTS Total hours-30

1. Demonstrate the Personal Computer Peripherals and get a report on each peripheral.
2. Demonstrate the Personal computer assembling procedure and do the same.
3. Install wide varieties of free and open source operating systems.
4. Demonstrate Network Interface Card (NIC) configuration and any internet browsers options setup.
5. Demonstrate the Java Development Kit (JDK) installation and environmental variable (PATH) setup.
6. Demonstrate the following experiments using Office automation tools.
    a. Text formatting and table.
    b. Mathematical equations.
    c. Watermarking using Analysis tool.
    d. Calculate student mark details.
    e. Create four types of charts.
    f. Import external data, sort & filter using Power Point tool.
    g. Create text and images with effects.
    h. Create animation and sound effects.
7. Demonstrate the installation of anti-virus software to detect different types of virus programs.

TEXT BOOK :

1. Peter Norton, “Introduction to Computers”, 7th edition, Tata-McGrawHill, 2010.

REFERENCE BOOKS:

1. ITL Education Solution Limited, “Introduction to Computer Science”, 2nd edition, Pearson Education, 2011.
2. Eric Maiwald, “Fundamentals of Network Security”, 3rd edition, Tata-McGrawHill, 2004.

16CS102 COMPUTER PROGRAMMING

Hours Per Week :

L	T	P	C
3	1	2	5

Course Description and Objectives:

This course is aimed at offering fundamental concepts of programming language to the students. It starts with the basics of C-programming and deals with the structure and various attributes required for writing a 'C' program. It also introduces various operators and control statements used in programming. Then it switches to functions and arrays. It goes on with strings, pointers, files & the user defined data types. As a first-level course in computer science, it forms the basis to understand usage of various attributes in writing a program.

Course Outcomes:

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

CO1: Understanding of how to write simple, but complete C programs.

CO2: Identification of suitable data types for operands and design of expressions having right precedence.

CO3: Application of decision making and iterative features of C Programming language effectively.

CO4: Design and development of problem specific data structures and accessing methods to build large modular programs.

CO5: Development of C programs that are understandable, debuggable, maintainable and more likely to work correctly in the first attempt.

SKILLS:

- ✓ *Identify suitable data types for an application.*
- ✓ *Apply control statements for decision making problems.*
- ✓ *Use multidimension array for matrix application.*
- ✓ *Design a program to calculate average of a class.*
- ✓ *Analyze the difference between static & dynamic memory allocation.*

UNIT - 1 **L- 10,T-3**

INTRODUCTION TO C PROGRAMMING: Structure of C program - Comments, Processor statement, Function header statement, Variable declaration statement and Executable statement; C character set, Constants, Identifiers, Operators, Punctuations, Keywords, Modifiers, Identifiers, Variables, C scopes, Basic data types, Type qualifiers, Storage classes, Reading and writing characters, Formatted I/O.

UNIT - 2 **L- 9,T-3**

OPERATORS AND CONTROL STATEMENTS: Operators - Assignment, Arithmetic, Relational, Logical, Bitwise, Ternary, Address, Indirection, Sizeof, Dot, Arrow, Parentheses operators; Expressions - Operator precedence, Associative rules; Control statements - Category of statements, Selection, Iteration, Jump, Label, Expression and Block.

UNIT - 3 **L- 9,T-3**

FUNCTIONS AND ARRAYS: Function - Declaration, Prototype, Definition, Calling by value and call by address, Standard library functions and Recursive functions; Array - Declaration, Initialization, Reading, Writing, Accessing and Passing as a parameter to functions, 2D-arrays, Multidimensional arrays.

UNIT - 4 **L- 9,T-3**

STRINGS AND POINTERS: Strings - Declaration, String library functions, Array of strings, Command line arguments; Pointers - Declaration, Initializing pointers, Multiple indirection, Relationship between arrays and pointers; Scaling up - Array of arrays, Array of pointers, Pointer to a pointer, Pointer to an array; Pointer to functions, Dynamic memory allocation functions.

UNIT - 5 **L- 8,T-3**

STRUCTURES AND FILES: Structures - Declaration, Initialization and accessing, Array of structures and passing structures to functions, Structure pointers, Arrays and structures within structures, Unions, Bit-fields, Types and enumerations; Files - I/O and processing operations on text and binary files; Pre-processor directives.

LABORATORY EXPERIMENTS

Course Outcomes:

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

- write, compile and debug programs in C language.
- formulate problems and implement algorithms in C.
- develop programming components that efficiently solve computing problems in real-world.

LIST OF EXPERIMENTS Total hours-30

1. Compute the factors of a number.
2. Compute the average of 'n' numbers.
3. Find whether a number is palindrome or not.
4. Find whether a number is a power of 2 or not.
5. Compute the factorial of a number.
6. Implement any kind of operation (+,-,*,/,%) using a switch case.
7. Swap two values useing call by value and call by reference.
8. Using structure of arrays.

ACTIVITIES:

- *Implement matrix operations.*
- *Implement malloc and calloc functions.*
- *Copy the content of one file into the other.*
- *Implement string manipulations functions.*

9. Find the reversal of a number.
10. Find the frequency of each number in the array.
11. Which takes 0's & 1's as input and the array should consist of all 0's first and then 1's.
12. Copy the first 10 words of a file into the other file.
13. Count the number of words in a file.
14. Create a structure which stores the student's information in a class.
15. Reverse the contents of the array.
16. Implement pointer of pointers.
17. Give n^{th} term of the Fibonacci number.
18. Find the factorial of a number using recursion.
19. Find the number of vowels in a file.
20. Access the structure and union members.

TEXT BOOK:

1. Ajay Mittal, "Programming in C - A practical Approach", 1st edition, Pearson Education, India, 2015.

REFERENCE BOOKS:

1. Reema Thareja, "Introduction to C Programming", 2nd edition, Oxford University Press India, 2015.
2. Herbert Schildt, C, "The Complete Reference", 4th edition, Tata McGraw-Hill, 2000.
3. E. Balagurusamy, "Programming in ANSI C", 4th edition, Tata McGraw- Hill, 2008.

16EE101 BASICS OF ENGINEERING PRODUCTS

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course enables the students to understand the basics of civil, mechanical, electrical and electronics systems and components used in day-to-day life. It deals with construction materials, power generation principles and working of a few commonly used household appliances. Besides, the student will be able to identify/appreciate various concepts, service and maintainance of engineering products.

Course Outcomes:

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

CO1: Describe the working principle of Refrigeration and Air conditioning systems.

CO2: Gain awareness on choosing appropriate construction materials.

CO3: Operate and maintenance of basic electrical engineering appliances.

CO4: Analyze the different lighting sources and it's features.

CO5: Understand working of the basic electronics engineering appliances.

SKILLS:

- ✓ *Identify UPS requirements for a given load.*
- ✓ *Provide a Lighting scheme for specific working environment.*
- ✓ *Design a composition of Heating element for a particular application.*
- ✓ *Trouble shoot issues relating to Immersion Heater and Induction Heater.*
- ✓ *Provide an earthing for Domestic Outlet.*
- ✓ *Select, Configure and maintain a few engineering appliances. Such as TV, Radio, Telephone, Mobile phone, Wifi Router, Micro oven, PA system etc.*

ACTIVITIES:

- *Trouble shooting of immersion heater and induction heaters.*
- *Disassembe and Assembe the Domestic Appliances such as Mixer Grinder, Fan etc.,*
- *Provide Earthing for Domestic Outlet.*
- *Design the Electric Wiring system for a prototype house.*
- *Design the UPS for a defined load.*
- *Practice assembly of a FM radio.*
- *Configure a Wifi Router for required number of users.*

UNIT - 1 **L- 9**

WORKING PRINCIPLE OF AC, REFRIGERATOR, PUMPS, IC ENGINES AND SCREW JACK: Working principle of Air - Conditioner and Refrigerator, Components, Assembly and disassembly; Working principle of Centrifugal and Reciprocating pumps - Types, Parts and applications, Working principle of Screw jack and its components, Working principle of IC engines- 2 stroke and 4 stroke.

UNIT - 2 **L- 10**

BRICKS: General, Qualities and Classification of bricks, Tests for bricks, Size and Weight of bricks, Timber - Definition, Qualities of good timber, Decay of timber and Advantages of timber in construction.

CEMENTS: Types and composition of Cement, Setting of cement, Tests for physical properties of cement, Different grades of cement.

AGGREGATES: Classification of aggregates, Source, Size and Shape of aggregates, Tests for aggregates.

STEEL: Types of steel, Physical properties and Mechanical properties of steel, Simple layout design, Paints, Tiles, fittings, Ventilation, Furniture and green house aspects.

UNIT - 3 **L-08**

ELECTRIC ENERGY SYSTEMS: Overview of Power System Structure, Conventional and Non Conventional Generations, Types of Turbines, Generators, Substations, Towers, Earthing procedure, Protection schemes, Single Phase and Three Phase Systems, Methods of Electrical Wiring Systems, Wiring procedure and calculations, Wiring methods, Un-Interruptible Power Supply (UPS), Components in UPS, Its functionality, Calculation of ratings for UPS components to a specific load.

UNIT - 4 **L-10**

LIGHT: Light Energy, Evolution of Light sources, Working of Incandescent, Fluorescent, MV, SV and LED Lamps, Comparison and Applications.

HEAT: Heat Energy, Modes of Heat Transfer, Resistance and Induction Heating, Comparison and applications.

MOTOR: Electric Motors, Classification, Construction and working principles of motors used in Domestic applications, Mixer grinder, Ceiling and exhaust fan, Hair dryer, Washing machine, Water pump, Air coolers, Vacum cleaner, Computer cooling motor, Electric bike.

UNIT - 5 **L-8**

HOUSE HOLD ELECTRONIC APPLIANCES: Working principles of television, Radio, Remote control, Telephone, Microwave oven, Cell phone, PA system, Induction stove, WiFi router and DTH.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS Total hours-30

Demonstration of Modelling / functioning / disassembly / assembly / fault rectification / understanding of the following.

1. Air-conditioners and Refrigerators
2. 2 Stroke and 4 Stroke Engines
3. Reciprocating Pumps
4. Power Screw Jack
5. Size and Water absorption capacity of Bricks
6. Initial and final setting time of Cement
7. Toughness value of coarse aggregates
8. Bulking of Sand
9. Earthing Schemes
10. Electric Wiring
11. UPS system
12. Immersion Heater, Induction Heater and Iron Box
13. Ceiling Fan and Mixer
14. Television
15 Radio
16. Remote Control
17. Telephone
18. Fax Machine
19. Mobile Phone
20. PA System

TEXT BOOKS:

1. M.S.Shetty, “Concrete Technology”, 1st edition, S.Chand and Co, 2005.
2. S. C. Rangwala, “Engineering Materials”, 36th edition, Charotar Publishing House, Anad, 2009.
3. Govindasamy and A Ramesh, “Electrical engineering - Electrical machines and Appliances Theory, 1st edition, Tamilnadu text book corporation, 2010.
4. Janakaraj, A Sumathi et al, “Electrical engineering - Electrical machines and Appliances Theory”, 1st edition, Tamilnadu text book corporation, 2011.
5. Marshall Brain, “How Stuff Works”, 1st edition, John Wiley&Sons, 2001.
6. Pravin Kumar, “Basic Mechanical Engineering”, 1st edition, Pearson Publishers, 2013.

16HS104 ENGLISH PROFICIENCY AND COMMUNICATION SKILLS

Hours Per Week :

L	T	P	C
0	-	2	1

Course Description and Objectives:

To equip the students with Functional English by exposing them to a wide range of language use in different contexts and thereby encourage them to use the language comfortably in real life situations. The objective of this course is to strengthen the comprehension skills of listening and reading by acquiring adequate vocabulary through perusing authentic materials gathered from news papers, journals and other mass communication media.

Course Outcomes:

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

CO1: Can understand routine information and factual articles in the news papers and understand general instructions, notifications, announcements, monologues and conversations. (Understand)

CO2: Use functional English to speak and express themselves in everyday social contexts. (Apply & Create)

CO3: Applying sentence structures and word collocations to produce simple and accurate sentences and create short compositions.

CO4: Analyse complex reading and listening materials and draw inferences to evaluate the intentions of the writers and speakers.

CO5: Creating concise and precise communication by analysing the relevance of the context and applying suitable formats.

SKIL LS:

- ✓ *Use appropriate words in right order for effective sentence formation, and writing short texts.*
- ✓ *Read and extract information from different texts and draw inferences by understanding elements like tone and transitional words.*
- ✓ *Understand short and long spoken discourses through analysis of elements like stress and intonation.*
- ✓ *Articulate clearly thoughts and ideas on simple every day topics.*

UNIT - 1 **P-6**

FUNCTIONS: Introducing Self/Others, Expressing needs/feelings/opinions (SWOT Analysis)

SKILL FOCUS:

Reading – Understanding factual information

Writing – Word order and sentence formation

Listening – Decoding for meaning following elements of stress, Intonation and accent

Speaking – Articulating syllables clearly, Speaking fluently with correct pronunciation

Vocabulary – Discerning to use right word for the given context

Grammar – Spellings, Use of Nouns, Adjectives, Verbs, Prepositions in the sentence structure

PRACTICE: Objective PET Units 1 - 6

UNIT - 2 **P-6**

FUNCTIONS: Defining; Describing People, Places, Things and Process.

SKILL FOCUS:

Reading – Inferences from sentences and short messages, True or False

Writing – Rewording, Sentence transformation, Convincing

Listening – Understanding the short messages and conversations

Speaking – Role-plays, Short conversations

Vocabulary / Grammar – Use of Adjectives/Adverbs, Comparatives and Superlatives

PRACTICE: Objective PET Units 7 – 12

UNIT - 3 **P-6**

FUNCTIONS: Describing Spatial and Temporal Relations, Giving Directions/Instructions

SKILL FOCUS:

Reading – Reading between the lines, Inferences, True/False

Writing – Developing hints, Writing short messages/paragraphs

Listening – Searching for factual information, Gap filling

Speaking – Snap Talks, JAM, Elocution

Vocabulary / Grammar – Prepositions, Phrasal Verbs, PET word list

PRACTICE: Objective PET Units 13 - 18

UNIT - 4 **P-6**

FUNCTIONS: Narrating, Predicting, Negotiating, Planning

SKILL FOCUS:

Reading – Reading for evaluation and appreciation, Comprehension

Writing – Letters, e-mails, 7 C's

Listening – Following long conversations / Interviews

Speaking – Discussions, Debate, Descriptions

Vocabulary / Grammar – Modals, Conditionals, Verb forms (Time and Tense)

PRACTICE: Objective PET Units 19 – 24

ACTIVITIES:

- *SWOT Analysis.*
- *Snap talks.*
- *Spell Bee.*
- *Short conversations.*
- *Role play.*
- *Quiz.*
- *Elocution.*
- *JAM.*
- *Group. Discussion Debate.*
- *Team presentations.*

UNIT - 5 **P-6**

FUNCTIONS: Requesting, Denying, Suggesting, Persuading

SKILL FOCUS:

Reading – Understanding factual information

Writing – Short Stories, Explanatory Paragraphs

Listening – Inferences from long speeches/conversations

Speaking – Announcements, Presentations

Vocabulary / Grammar - Punctuation, Cloze tests

PRACTICE: Objective PET Units 25 – 30

TEXT BOOK:

1. Louise Hashemi and Barbara Thomas, "Objective PET", Student's Book with Answers, 2nd edition, Cambridge University Press, 2015.

REFERENCE BOOKS :

1. Cambridge Preliminary English Test Without Answers 8.
2. Annette Capel and Rosemary Nixon, "Introduction to PET", Oxford University Press.

16HS110 ENGINEERING PHYSICS LABORATORY

Hours Per Week :

L	T	P	C
-	-	3	2

Course objectives and Description:

This lab is intended to make the students realize the theoretical concepts of physics having hands on experience in conducting the experiments.The students have to perform at least ten from the list of experiments.

Course Outcomes:

The student will be able to:

CO1: Realize the concept of resonance by conducting the experiments of AC sonometer and Melde'sexperiment.

CO2: Acquire the knowledge on magnetic field theory and thermal conductivity by conducting experiments,

CO3: Understand Magnetic field along the axis of a circular coil and thermal conductivity of bad conductor through experiments.

CO4: Understand the concepts of light by conducting the experiments of determination of wavelength,

CO5: Understand the numerical aperture of an optical fibre and also from V–I characteristics of Solar celland LED.

LIST OF EXPERIMENTS

1. Determination of Velocity of ultrasonic waves in liquids.
2. Melde's Experiment - Transverse and Longitudinal modes.
3. Determination of wave length – Helium - Neon laser.
4. Determination of Planck's constant.
5. Determination of Frequency of Alternating current.
6. Field along the axis of a circular coil – Stewart and Gee's apparatus.
7. Band gap of semiconductor.
8. Determination of Hall coefficient.
9. Thermal conductivity of bad conductor - Lee's method.
10. Optical Fibre – Determination of numerical aperture.
11. Solar Cell – Efficiency.
12. Study of V – I characteristics of LED.
13. Seebeck effect - Determination of Seebeck coefficient of a thermo couple.

REFERENCE BOOKS:

1. Jayaraman, "Engineering Physics Laboratory manual", 1st edition, Pearson Education, 2014.
2. Engineering Physics laboratory Manual – Department of Physics, VFSTR University, 2016.

16HS108 ENGINEERING MATHEMATICS – II

Hours Per Week :

L	T	P	C
3	1	2	5

Course Description and Objectives:

It is aimed to offer different methods for finding rank of a matrix, solving linear equations using matrices, to compute Eigen values and Eigen vectors, to verify C.H.T and apply it to find power of a matrix. Also, to make the students familiarize with double and triple integrals, to make the student acquainted with the concepts of vector differentiation and integration. To make the student to use different mathematical tools of MATLAB related to above concepts.

Course Outcomes:

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

CO1: Determine rank of a matrix and solution of a system of linear equations, Eigen values and Eigen vectors.

CO2: Apply Cayley-Hamilton theorem for finding inverse and power of a matrix.

CO3: Illustrate the use of multiple integrals.

CO4: Understand the concepts of vector differentiation and integration.

CO5: Apply software tools to obtain and verify the solutions.

SKILLS:

- ✓ *Appreciate various methods to find the rank of a matrix.*
- ✓ *Solve given system of linear equations.*
- ✓ *Compute Eigen values and Eigen vectors of a matrix.*
- ✓ *Compute the power of a matrix by suitable method.*
- ✓ *Evaluate Multiple integrals.*
- ✓ *Evaluate surface and volume integrals through vector integral theorems.*

UNIT - 1 **L-9,T-3**

RANK OF MATRIX AND LINEAR EQUATIONS: Rank of a matrix, Normal form, Triangular form, Echelon from, Consistency of system of linear equations, Gauss-Jordan method, Gauss elimination method, Gauss-Siedal method.

UNIT - 2 **L-9,T-3**

EIGEN VALUES AND EIGEN VECTORS: Eigen values, Eigen vectors, Properties (without proofs), Cayley-Hamilton theorem (without proof), Power of a matrix, Diagonalisation of a matrix.

UNIT - 3 **L-9,T-3**

MULTIPLE INTEGRALS: Double integrals, Evaluation, Evaluation in polar coordinates, Change of order of integration, Change of variables, Applications to area in cartesian coordinates and polar coordinates, Triple integrals, Fundamentals, Evaluation of triple integrals.

UNIT - 4 **L-9,T-3**

VECTOR DIFFERENTIATION: Vector function, Differentiation, Scalar and vector point function, Gradient, Normal, Divergence, Directional derivative, Curl, Vector identities.

UNIT - 5 **L-9,T-3**

VECTOR INTEGRATION: Line integral, Surface integral, Volume integral, Green's theorem, Stoke's theorem, Gauss theorem of divesergence (without proofs).

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS Total hours-30

1. Matrix Algebra.
2. Rank of a matrix.
3. System of equations (Direct method).
4. System of equations (Cramer's Rule).
5. System of equations (matrix inversion method).
6. Eigen values and Eigen vectors of a matrix.
7. Powers of matrix & Cayley-Hamilton Theorem.
8. Vector algebra.
9. Gradient.
10. Divergence.
11. Curl.
12. Multiple Integrals (Area etc).
13. Interpolation.

TEXT BOOKS:

1. H. K. Dass and Er. Rajanish Verma, "Higher Engineering Mathematics", 3rd edition, S. Chand & Co., 2014.
2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th edition, 2014.
3. Rudra Pratap, "Getting started with Matlab", Oxford University Press, 2009.

REFERENCE BOOKS:

1. Srimanta Pal and Subodh C. Bhunia, "Engineering Mathematics", Oxford Publications, 2015.
2. B. V. Ramana, "Advanced Engineering Mathematics", 25th reprint, McGraw Hill Education, 2015.
3. R K Jain and S R K Iyengar, "Advanced Engineering Mathematics", 2nd edition, Narosa Publishing House, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th edition, John Wiley & Sons (Asia) Pvt. Ltd., 2001.

ACTIVITIES:

- *Differentiate the methods to find the rank of a matrix.*
- *Solve given system of linear equations and compare with MATLAB output.*
- *Compute Eigen values and Eigen vectors of a matrix and compare with MATLAB output.*
- *Compute the power of a matrix by suitable method.*
- *Evaluate multiple integrals and compare with MATLAB output.*
- *Evaluate surface and volume integrals through vector integral theorems.*

16HS107 ENGINEERING CHEMISTRY

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

This course aims to develop fundamental knowledge on new engineering materials and their significance in science and engineering applications. In addition, characterization of materials using basic and advanced experimental techniques is also offered. Besides, analysis of water sample and treatment method for domestic, commercial and industrial applications are also covered.

Course Outcomes:

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

CO1: Analyze the quality of the water and design a suitable water purification mechanism.

CO2: Apply the principle of electrochemistry for designing various batteries and fuel cells.

CO3: Analyze various factors effecting corrosion and apply proper corrosion control and prevention methods.

CO4: Familiarize the preparation, properties and applications of various polymers.

CO5: Apply the electromagnetic radiation to the spectroscopic methods for the analysis of engineering materials.

SKILLS:

- ✓ *Analyse the total hardness of water sample.*
- ✓ *Understand the basic principles involved in various batteries.*
- ✓ *Understand the mechanisms of corrosion and various controlling methods.*
- ✓ *Synthesize various polymers.*
- ✓ *Identify the functional groups present in chemical compounds using Infrared and Ultraviolet instruments.*

UNIT - 1 **L-9**

WATER TECHNOLOGY: Introduction, WHO, BIS standards of water, Hardness of water, Determination of hardness by EDTA (Numerical Problems), Disadvantages of hard water, Scales and sludges, Caustic embrittlement, Boiler corrosion, Priming and foaming, Softening methods - Zeolite process, Ion Exchange process; Desalination of brackish water - Reverse osmosis, Electrodialysis.

UNIT - 2 **L-9**

ELECTRO CHEMISTRY: Electrode potential, Electrochemical series, Nernst equation, Reference electrodes, Calomel and standard hydrogen electrode, Ion selective electrode, Glass electrode, Determination of pH using glass electrode; Primary cell, Secondary cell - Lead-acid storage cell, Lithium ion battery; Fuel cells - Hydrogen oxygen, Methanol oxygen.

UNIT - 3 **L-9**

SCIENCE OF CORROSION: Introduction, Dry corrosion, Wet corrosion, Mechanisms of wet corrosion, Bimetallic corrosion, Concentration cell corrosion, Factors influencing the rate of corrosion; Corrosion control methods - Cathodic protection, Electroplating, Electrolessplating, Corrosion inhibitors.

UNIT - 4 **L-9**

POLYMERS: Introduction, Types of polymerization - Preparation, Properties and applications of polyethylene, PVC, Teflon, Bakelite, Urea formaldehyde, Silicones; Rubber, Vulcanization, Synthetic rubbers - Buna-S, Buna-N, Neoprene; Introduction to conducting polymers; Poly thiophene.

UNIT - 5 **L-9**

INSTRUMENTAL TECHNIQUES: Interaction of radiation with matter, UV-Visible spectroscopy - Beer, Lambert's law, Qualitative and quantitative analysis, Block diagram of UV-Visible spectrophotometer, IR spectroscopy - Types of vibrations, Block diagram of IR spectrophotometer.

TEXT BOOKS:

1. P.C Jain and Monica Jain, "Engineering Chemistry", 17th edition, Dhanpat Rai Publications, 2010.
2. Shashi Chavala, "A Text book of Engineering Chemistry Engineering Materials and Applications", 3rd edition, Dhanpat Rai Publications, 2015.

REFERENCE BOOKS:

1. K.S. Maheswaramma and Mridula chugh, "Engineering Chemistry", 1st edition, Pearson publication, 2015.
2. M.R. Senapati, "Advanced Engineering Chemistry", 2nd edition, Lakshmi Publications, 2006.
3. H. W. Wilard and Demerit, "Instrumental methods of Analysis", 7th edition, CBS Publications,1986.
4. Gurudeep Raj and Chatwal Anand, "Instrumental Methods of Analysis", 5th edition, Himalaya Publications, 2007.

ACTIVITIES:

- *Collect water samples from different villages near VFSTR University and determine the total hardness, and total alkalinity.*
- *Present the water analysis report to the villagers and suggest proper measures to be taken.*
- *Measure the rate of corrosion of iron objects by weight loss method.*
- *Identify some of the functional groups like carboxylicacid, aldehyde and ketones by I.R. Spectroscopy.*
- *Collect water sample from different villages and estimate the fluoride present in the raw water and suggest some steps for the removal of fluoride.*

16ME101 ENGINEERING GRAPHICS

Hours Per Week :

L	T	P	C
1	-	3	3

Course Description and Objectives:

The main aim of this course is to familiarize the students with the conventional concepts of engineering drawing and computer aided applications in various fields. Engineering graphics is an “International language of Engineers”. It is the most effective method of communicating technical ideas in a 2D and 3D format.

Course Outcomes:

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

CO1: Communicate the ideas and thoughts to other in the form of pictures.

CO2: Develop the drawing skills while drawing engineering objects.

CO3: Implement the concept of quadrant system in drawing practice.

CO4: Construct different engineering objects using drawing tools.

CO5: Sketch simple objects and their pictorial views using AutoCAD.

SKILLS:

- ✓ *Draw free hand sketches, layouts, circuit diagrams, plan and elevations.*
- ✓ *Draw geometrical objects like polygons, solids of different types.*
- ✓ *Visualize the objects in real time situations.*
- ✓ *Develop 3D views (isometric views).*

UNIT – 1 **L-3, P-10**

INTRODUCTION TO ENGINEERING DRAWING: Types of lines, Lettering, Dimensioning, Construction of polygon and conics (Ellipse, Parabola and Hyperbola by general method), Ellipse by oblong method.

UNIT – 2 **L-3, P-8**

ORTHOGRAPHIC PROJECTIONS: Principle of projection, Planes of projections, Projections of points, Projection of straight lines, Inclined to one plane and both the planes, Projections of planes, Simple planes, Planes inclined to one reference planes.

UNIT – 3 **L-3, P-8**

PROJECTIONS OF SOLIDS: Projections of prisms, Pyramids, Cylinders, Cones, Solid axis inclined to one plane.

UNIT – 4 **L-3, P-10**

AUTOCAD: Introduction to AutoCAD

ISOMETRIC VIEWS: Isometric drawing of simple objects, Isometric view of prisms, Pyramids, Cone and cylinder, Simple orthographic views into isometric views through AutoCAD.

UNIT – 5 **L-3, P-9**

ORTHOGRAPHIC VIEWS: Conversion of pictorial views into orthographic views through AutoCAD.

TEXT BOOKS:

1. N.D.Bhatt, “Engineering Drawing”, 53rd edition, Charotar Publication, 2014.
2. Basant Agrawal, C.M.Agrawal “Engineering Drawing” , 2nd edition., Tata McGraw Hill,2014.

REFERENCE BOOKS:

1. J. hole, “Engineering Drawing”, 2nd edition, Tata McGraw Hill, 2008.
2. K.L. Narayana, “Engineering drawing”, 2nd edition, Scitech Publications, 2008.

ACTIVITIES:

- *Draw line diagram of different machineries.*
- *Draw plan and elevations of buildings and engineering products.*
- *Understand, visualize 3-D components/ products and develop drawings.*
- *Draw different curves used in several engineering applications such as bridges, dams etc.*

16EE102 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course provides an in-sight into the functioning of basic electrical components like resistor, inductor and capacitor. It deals with the constructional and operational details of both D.C & A.C machines. It also deals with the basic electronic components like P-N Junction Diode, Zener diode, Transistor and their characteristics.

Course Outcomes:

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

CO1: Analyze the resistive circuits and solution of resistive circuits with independent sources.

CO2: Solve the AC (single and three phase) and DC circuits using different methods.

CO3: Familiarize the concepts of electro magnetism and it's applications.

CO4: Explain the types of electrical equipment, machines and its applications.

CO5: Acquire the knowledge about the characteristics and working principles of semiconductor diodes, Bipolar Junction Transistor

SKILLS:

- ✓ *Distinguish between linear and nonlinear elements by looking at VI characteristics.*
- ✓ *Develop a simple loop generator.*
- ✓ *Design a voltage regulator using Zener diode.*
- ✓ *Design a half wave rectifier using PN junction diode.*
- ✓ *Design a full wave rectifier using PN junction diodes.*

UNIT – 1 **L-9**

FUNDAMENTALS OF DC CIRCUITS: Circuit concepts, Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, R, L and C as linear elements, Ohm's Law, Kirchhoff's Laws - Application to simple series, Parallel circuits, Mesh and nodal analysis of simple resistive circuits (Simple numerical problems).

UNIT – 2 **L-9**

FUNDAMENTALS OF A.C. CIRCUITS: Generation of A.C. voltage - Frequency, Average value, R.M.S. value, Form factor, Peak factor for sinusoidal only, Phasor representation of alternating quantities, Analysis of simple series and parallel A.C. circuits (simple numerical problems).

BALANCED THREE PHASE SYSTEMS: Relation between phase and line quantities of voltages and currents in star and delta connected systems (Elementary treatment only).

UNIT – 3 **L-9**

FUNDAMENTALS OF ELECTROMAGNETISM: Concepts of Magneto motive force, Reluctance, Flux and flux density, Concept of self Inductance and mutual Inductance, Coefficient of coupling (only elementary treatment and Simple numerical problems).

TRANSFORMERS: Principle of operation of single phase transformer, Constructional features, EMF equation (simple numerical problems).

UNIT – 4 **L-9**

DC MACHINES: Constructional details of a D.C. Machine, D.C. Generator, Principle of operation, EMF equation, Types of D.C. generators (simple numerical problems), D.C. Motor, Principle of operation, Torque equation, Types of D.C. motors (simple numerical problems).

A.C MACHINES: Principle of operation of three phase induction motors, Slip ring and squirrel cage motors, Torque equation, Constructional details of synchronous machine.

UNIT – 5 **L-9**

SEMICONDUCTOR DEVICES: Classification of solids based on energy band theory, Intrinsic and Extrinsic semiconductors, P-type and N-type semiconductors, P-N junction diode and its characteristics, Half and Full wave rectifiers, Zener diode and its characteristics, Voltage regulator, Bi polar junction transistor, Operation, Types, Applications.

ACTIVITIES:

- *Decoding the value of resistors.*
- *Design and fabricate a simple loop permanent magnet generator.*
- *Design and fabricate a simple air cored transformer.*
- *Fabricate full and half wave rectifiers using PN junction diodes.*
- *Fabricate a voltage regulator using Zener diode.*

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

- apply the ohm's law, KVL and KCL laws to different circuits.
- calculate the power and energy in electric circuits.
- operate and find the transformation ratio of transformer at different loads.
- study and verify the characteristics of semiconductor devices.
- calculate the efficiency of both HWR and FWR.

LIST OF EXPERIMENTS Total hours-30

1. Verification of Ohm's law.
2. Verification of Kirchhoff's current law.
3. Verification of Kirchhoff's voltage law.
4. Measurement of Energy in single phase resistive load circuit.
5. Measurement of Power in single phase resistive load circuit.

6. Transformation ratio of a single phase transformer at different loads.
7. Verification of PN junction diode characteristics under both forward and reverse bias.
8. Verification of Zener diode characteristics under both forward and reverse bias.
9. Implementation of Half Wave Rectifier without filter.
10. Implementation of Full Wave Rectifier without filter.

TEXT BOOKS:

1. V.K.Mehta, "Principles of Electrical Engineering and Electronics", 3rd edition, S. Chand Publications, New Delhi, 2010.
2. D.P Kothari, "Basic Electrical and Electronics Engineering", 1st edition., TMH, New Delhi, 2014.

REFERENCE BOOKS:

1. Millman & Halkias, "Integrated Electronics", McGraw Hill, 1979.
2. A.K. Thereja and B.L. Thereja, "Electrical Technology", Vol.– II, S Chand Publications, 2007.
3. U.Bakshi & A.Bakshi, "Basic Electrical Engineering", 1st edition., Technical Publications, Pune, 2005.

WEB LINKS:

1. http:// nptel.ac.in/courses/108108076/
2. https:// books.google.co.in/books/about Basic_Electrical_Engineering.html?id=xN8qZFRkLpYC

16HS111 ENGINEERING CHEMISTRY LABORATORY

Hours Per Week :

L	T	P	C
-	-	3	2

Course description and Objectives:

This course is aimed at enlightening the importance of theoretical concepts of chemistry and experimental techniques for characterization of materials.

Course Outcomes:

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

CO1: Analyse the quality of the water by volumetric methods.

CO2: Apply the principle of electrochemistry to determine the relative strength of oxidizing/reducing agents for the sample analysis.

CO3: Analyse various factors effecting the rate of corrosion by using weight loss method

CO4: Synthesize and analyse various polymers useful for engineering applications.

CO5: Apply instrumentation methods for chemical analysis.

LIST OF EXPERIMENTS

1. Determination of Total Alkalinity of water.
2. Estimation of Total hardness of water.
3. Find the percentage of available chlorine in Bleaching powder.
4. Estimation of Fe (II) by Dichrometry method.
5. Preparation of Phenol - Formaldehyde Resin.
6. Synthesis of Urea- Formaldehyde Resin.
7. Estimation of Concentration of acid by pH metry.
8. Determination of Strength of acid by Conductometry.
9. Measurement of Mn^{+7} by Colorimetry.
10. Determination of concentration of a salt by ion exchange method.
11. Find the concentration of Mn^{+7} and Cr^{+6} by UV-Visible Spectrophotometry.
12. Find the rate of corrosion by weight loss method.

TEXT BOOKS:

1. J.Mendham, R.C.Denney, J.D. Bares, M.Thomas and B.Siva Sankar, “Vogel’s Text book of qualitative Chemical Analysis”, Pearson Publications - Volume I, 2009.
2. Dr.Sunita Rattan “Experiments in Applied Chemistry”, S.K. Kataria & Sons Publications, 2008.

16HS109 ENVIRONMENTAL SCIENCE AND TECHNOLOGY

Hours Per Week :

L	T	P	C
2	-	-	2

Course Description and Objectives:

Environmental Science and Technology offers technological aspects of environmental science and in maintaining environmental integrity in relation to human development. It helps every engineer to plan appropriate strategies for addressing environmental issues and also contribute to the development of innovative technologies for solving such issues. It produces professionals who will ensure sustainable development of the nation in general and environmental in particular.

Course Outcomes:

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

CO1: Observation and integration of diverse information from variable sources outside of the classroom and helps students to think critically, creatively, resourcefully, and strategically, including identifying steps needed to reach goals, manage projects, evaluate progress, and adapt approaches, developing both self reliance, and civic mindedness.

CO2: Collaborating across diverse disciplines and practices to identify and create solutions that conserve and help manage biodiversity for the long term.

CO3: Analyze the sources of pollutants and their effects on atmosphere and Adapting eco-friendly technologies and maintain hygienic conditions.

CO4: Identify the evidence of Global warming, Ozone depletion and acid rain.

CO5: Recognize safe receiving storing and handling of raw and prepared food and maintain hygienic conditions.

SKILLS:

- ✓ *Understand structural relationships, abstract models, symbolic languages and deductive reasoning.*
- ✓ *Gain perspectives to adrress the challenges, improvise and devise solutions.*
- ✓ *Identify solutions to environment and development issues, using planning, analysis, modeling, and new approaches.*
- ✓ *Acquire fieldwork techniques to study, observe and prepare documents, charts, PPTs, Models etc.*
- ✓ *Understand how natural resources should be used judiciously, to protect biodiversity and maintain ecosystem.*

UNIT - 1 **L-6**

NATURAL RESOURCES: Environmental studies - Definition scope and its importance, Need for public awareness; Natural resources - Forest resources, Deforestation, Water resources, Properties and conflicts, Mineral resources, Extraction and impacts, Food resources, Modern agriculture methods, Fertilizer pesticide problems, Water logging, Salinity, Energy resources, Renewable and non-renewable energy resources, Harness technology, Solar energy technologies, Land resources, Land degradation, Soil erosion; Role of an individual in conservation of natural resources.

UNIT - 2 **L-6**

ECOSYSTEMS AND BIODIVERSITY: Ecosystem - Concept, Structure and functions of an ecosystem, Food chains, Food webs, Ecological pyramids, Energy flow, Energy regulation, Succession, Biogeochemical cycles, Aquatic ecosystems; Biodiversity - Introduction, Bio-geographical classification, Values of biodiversity, Biodiversity at global, National and local levels, Hot-spots of biodiversity, Threats to biodiversity, Endangered and endemic species of India, Conservation of biodiversity.

UNIT - 3 **L-6**

WASTE MANAGEMENT AND GREEN TECHNOLOGY: Solid waste management - Causes, Effects and control measures of municipal and Industrial wastes; Pollution - Air, Water, Thermal, Soil and noise pollutions, Role of an individual in prevention of pollution; Remote sensing / GIS - Introduction, definitions, Applications of the remote sensing; Innovative practices - Objectives, Innovative practices in agriculture and forest community, Bio-villages; Green technology for sustainable development; Life cycle assessment and its concept.

UNIT - 4 **L-6**

SOCIAL ISSUES AND EIA: Sustainable development, Water conservation, Cloud seeding, Rainwater harvesting methods watershed management, Global warming, Acid rain, Ozone layer depletion, Environmental legislation - Wildlife protection act, Water act, Forest conservation act, Air act, Environmental protection act; Environmental Impact Assssment (EIA) - Introduction, Definition of E.I.A and E.I.S, Scope and objectives, Importance of E.I.A in proposed projects / industry / developmental activity.

UNIT - 5 **L-6**

ENVIRONMENTAL SANITATION: Food sanitation - Food and drugs Act, Food preservations, Milk sanitation, Tests for milk, Pasteurization of the milk; Water, Air, Soil and food borne diseases, Maintenance of sanitary and hygienic conditions; Role of youth in the development, Promoting activities, Youth as initiators, Field work/environmental visit - Visit to a local area to document environmental assets river/ forest/ grassland / hill /mountain, Study of local environment, Common plants, Insects, Birds; Study of simple ecosystems - Pond, River, Hill slopes etc., Visit to industries/water treatment plants/effluent treatment plants.

TEXT BOOKS:

1. Anubha Kaushik and CP Kaushik, “Perspectives in Environmental Studies”, 5th edition, 2016
2. Benny Joseph, “Environmental studies”, 2nd edition, McGraw Hill Education, 2015.

REFERENCE BOOKS:

1. Dr. M. Chandrasekhar, “A Text book of Environmental Studies”, HI-TECH publications, 2006.
2. Dr. M. Anji Reddy, “A Text book of environmental science and Technology”, B S Publications, 2008.
3. Dr. K. Mukkanti, “A Text book of Environmental Studies”, S.CHAND and Company Ltd, 2009.
4. EHILRS and ST, “Text book of Municipal and Rural Sanitation”, M.S Hill, 1998.
5. C. S. Rao, Wiley Eastern Ltd, “Environmental Pollution Control Engineering”, New Age International Ltd, 2001.
6. Dr. M. Anji Reddy, “Introduction to Remote Sensing”, B S Publications, 2004.

ACTIVITIES:

- *Painting contests on environmental issues and themes.*
- *Models of energy resources, Pollution and Solid Waste Management-3R strategy.*
- *Quiz competition.*
- *Essay writing competition.*
- *Skit, JAM and debate.*
- *Field work and documentation.*
- *Assignments.*

16CS202 DATA STRUCTURES

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course is aimed at offering fundamental concepts of data structures and explaining how to implement them. It begins with the basic concepts of data and data structures and introduces the primitive and non-primitive data structures in detail. It forms the basis for understanding various ways of representing data and its usage in different computing applications.

Course Outcomes:

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

CO1: Apply advanced C programming techniques such as pointers, dynamic memoryallocation, structures to develop solutions for particular problems.

CO2: Analyze characteristics of various data structures.

CO3: Differentiate between Graphs and Trees.

CO4: Derive the importance of sorting and applying it wherever useful.

CO5: Argue the usefulness of data structures in solving problems.

SKILLS:

- ✓ *Identify the required data structures for various applications.*
- ✓ *Identify the sorting algorithm suitable for a given scenario.*
- ✓ *Implement array or linked list for a given problem.*
- ✓ *Analyse Pros & Cons of each of the data structure.*
- ✓ *Usage of trees and graphs.*

UNIT - 1 **L-9**

SORTING AND SEARCHING: Introduction - Data, Data type, Data structure, Primitive and Non-primitive - Data type, Data structure; Storage structures - Sequential and linked storage representations; Applications of structures, Hashing.

SORTING: Selection sort, Bubble sort, Insertion sort, Quick sort, Merge sort.

SEARCHING: Binary search and linear search.

UNIT - 2 **L-9**

LINKED LISTS: Introduction, Types of linked list - Singly linked list, Doubly linked list, Circular linked List; Operations - Insertion, Deletion, Traverse forward/reverse order; Multi lists, Applications of linked lists.

UNIT - 3 **L-9**

STACKS AND QUEUES: Stacks - Introduction, Array and linked representations, Implementation and their applications; Queues - Introduction, Array and linked representations, Implementation and their applications, Types - Linear, Circular and doubly ended queues; Applications.

UNIT - 4 **L-9**

TREES: Introduction, Properties, Binary Tree - Introduction, Properties, Array and linked representations; Tree traversals and their Implementation, Expression trees, BST definition and implementation; AVL Trees - Definition and implementation.

UNIT - 5 **L-9**

GRAPHS: Introduction, Properties, Modeling problems as graphs representations - Adjacency matrix, Adjacency list; Traversals - Breath first search and depth first search; Application of graphs.

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

- understand the importance of structure, abstract data type and their basic usability in different applications through different programminglanguages.
- understand the linked implementation and its uses both in linear and non-linear data structure.
- understand various data structures such as stacks, queues, trees, graphs, etc. to solve various computing problems.
- decide a suitable data structure to solve a real world problem.

LIST OF EXPERIMENTS Total hours-30

1. Selection, Bubble, Insertion, Quick and Merge sorting algorithms.
2. Linear and Binary search algorithms.
3. Single linked list, doubly linked list, and circular linked list.
4. Stack using an array and linked list.
5. Queue using an array and linked list.
6. Tree using an array and linked list.
7. Check if given expression is fully parenthesis or not using stack.
8. Tree traversing techniques.

ACTIVITIES:

- *Design and Implement a School Management System.*
- *Design and Implement a Social Networking Site.*
- *Implement a project to find out the most common words in the articles.*
- *Design and Implement a Library Book Management System.*
- *Design and Implement a CricBuzz Application.*

9. BST using an array and linked list.
10. Graph traversal techniques.

TEXT BOOK:

1. ReemaThareja, “Data Structures Using C”, 2nd edition, Oxford University Press, 2014.

REFERENCE BOOKS :

1. Richard F. Gilberg and Bhrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, 2nd edition, Cengage Learning, 2004.
2. Jean Paul Tremblay and Paul G. Sorenson, “An Introduction to Data Structures with Applications”, 2nd edition, Tata Mc-Graw Hill, 2004.
3. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2nd edition, Pearson Education, 2006..

16ME103 WORKSHOP PRACTICE

Hours Per Week :

L	T	P	C
-	-	3	2

Course Description and Objectives :

This course is aimed to impart knowledge and provide hands-on experience in Carpentry, Fitting, Tinsmithy, Blacksmithy and House wiring. In addition it also provides knowledge on various manufacturing processes such as Foundary, Welding, Machine Shops and CNC Machines.

Course Outcomes :

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

CO1: Identify various tools connected to the trades such as Carpentry, Fitting, Tinsmithy,Blacksmithy and House wiring.

CO2: Understand Fabrication of wooden joints.

CO3: Understand joining of metals.

CO4: Make metal joints and sheet metal work.

CO5: Make metal tools like knives, needles, swords, arrows etc.

SKILLS:

- ✓ *Prepare wooden and metal furniture.*
- ✓ *Electrical wiring and power supply in residences.*
- ✓ *Make funnels, trays, locker, steel almirahs etc.*
- ✓ *Fabrication of various agriculture tools, hooks, axes, axels, rims etc.*
- ✓ *CNC machines and various machining operations and processes.*

ACTIVITIES:

- *To make wooden joints like Mortise and Tenon joint, T-lap Joint which are used to prepare a wooden furniture.*
- *To prepare metal joints and metal sheet products like V-Joint and trays by using mild steel flats and Galvonised iron sheets.*
- *Trials on electrical circuit connections.*

EXERCISES IN THE FOLLOWING TRADES :

1. Carpentry.
2. Fitting.
3. Tin smithy and Black smithy.
4. House wiring.
5. Foundry and welding (Demonstration).
6. Machine shop and CNC (Demonstration).

Note: In each trade, the student has to perform at least two jobs.

TEXT BOOKS:

1. S.K. Hazra Choudhury, "Elements of workshop Technology", 11th edition, Media Promoters, 1997.
2. Gopal, T.V., Kumar, T., and Murali, G., "A first course on workshop practice: Theory, Practice and Work Book", Suma Publications, Chennai, 2005.
3. Venkatachalapathy, V. S, "First year Engineering Workshop Practice", Ramalinga Publications, Madurai, 1999.

II

YEAR

ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.

I SEMESTER

16HS201	-	Complex Variables and Transformations
16EC201	-	Materials for Electonics Engineering
16EC202	-	Electronic Devices and Circuits
16EC203	-	Network Theory
16EC204	-	Signals and Systems
16EC205	-	Digital Electronics
	-	Employability and Life Skills Elective

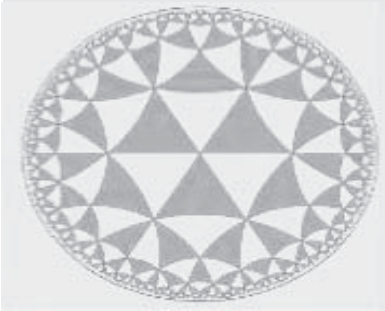
II SEMESTER

16EC206	-	Probability Theory and Stochastic Processes
16EC207	-	Electronic Circuit Analysis
16EC208	-	Analog Communications
16EC209	-	Linear Control Systems
16EL102	-	Soft Skills Laboratory
	-	Department Elective
	-	Department / Open Elective
	-	Employability and Life Skills Elective

COURSE CONTENTS

I SEM & II SEM

16HS201 COMPLEX VARIABLES AND TRANSFORMATIONS



Hours Per Week :

L	T	P	C
3	1	-	4

Course Description and Objectives:

In this course students will learn complex numbers, complex functions, analytic functions, complex integration and theory of residues. Laplace transformations and Z-transformations will be dealt with including applications. The objective of this course is to offer theory of complex functions, Laplace transformations, their inverses, Z-transformations and their applications.

Course Outcomes:

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

CO1: Apply the concept of Laplace transforms and solve differential equations.

CO2: Apply the concept of Z- transforms and evaluate the difference equations.

CO3: Understanding the concept of Analytical function and to construct the harmonic conjugate of the function.

CO4: Understand the concept of elementary function and evaluate complex integral using Cauchy's theorem and formula.

CO5: Evaluating Integral by using the concept of Residues.

CO6: Applications of Residue Theorem.

UNIT - 1 **L-9,T-3**

LAPLACE TRANSFORMATIONS: Introduction, Properties, Standard transformations, Change of scale property, Shifting properties, Laplace transformation of derivative and integral, Multiplication and division by *t*, Initial and final value theorems, Convolution theorem, Inverse Laplace transformations, Properties, Partial fractions method, Convolution, Applications, Solving ordinary differential equations using Laplace transformations.

UNIT - 2 **L-9,T-3**

Z – TRANSFORMATIONS: Introduction, Definition, Standard Z-transformations, Linear property, Damping rule, Shifting rules, Multiplication and division by *n*, Initial and final value theorems, Inverse Z-transformations, Convolution theorem, Applications to difference equations.

UNIT - 3 **L-9,T-3**

ANALYTICAL FUNCTIONS: Complex numbers, Properties including roots of a complex number, (Brief discussion), Functions of complex variables, Limit and continuity, Differentiability, Analytic functions, Cauchy-Riemann equations (without proof), Cauchy-Riemann equations in polar form (without proof), Orthogonal curve, Harmonic functions, Conjugate harmonic functions, Construction of conjugate harmonic function, Milne Thomson method.

UNIT - 4 **L-9,T-3**

ELEMENTARY FUNCTIONS AND COMPLEX INTEGRATION: Complex trigonometric functions, Hyperbolic functions, Relation between trigonometric and hyperbolic functions, Separation of real and imaginary parts of trigonometric and hyperbolic functions, Logarithmic function, Inverse functions, Line integral, Properties of contour integrals, Cauchy's integral theorem, Cauchy integral formula and its generalization, Evaluation of integrals.

UNIT - 5 **L-9,T-3**

RESIDUES: Convergence of series of complex terms, Power series, Region and radius of convergence, Taylor series, Maclaurin series and laurent series, Singularity, Classification of singularities, Pole at infinity, Zeros of analytic function, Residue of a pole, Residue at infinity, Residue theorem, Method of finding residues, Residue integrals.

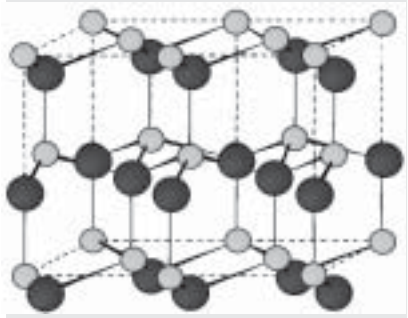
TEXT BOOKS:

1. H. K. Dass and Er. Rajanish Verma, "Higher Engineering Mathematics", 3rd edition, S. Chand & Co, 2014.
2. B. S. Grawel, "Higher Engineering Mathematics", Khanna Publishers, 44th edition, 2014.

REFERENCE BOOKS:

1. Srimanta Pal, Subodh C and Bhunia, "Engineering Mathematics", Oxford Publications, 2015.
2. B.V. Ramana, "Higher Engineering Mathematics", 3rd edition, Tata McGraw-Hill Publishing Co, 2008.
3. R K Jain, S R K Iyengar, "Advanced Engineering Mathematics", 2nd edition, Narosa Publishing House, 2006.

16EC201 MATERIALS FOR ELECTRONICS ENGINEERING



Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

This course deals with the different materials used for electnoic device fabrication and their properties. The objective of the course is to introduce the students to structure and properties of materials, that are required for the design and construction of solid state devices. In addition, it provides introduction to the interrelations of the structure, properties and processing of materials.

Course Outcomes:

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

CO1: Classification of materials and Understand the crystal structure.

CO2: Understand the fundamentals of the physical, mechanical, thermal and electronic properties of materials.

CO3: Apply all the electronic Properties of the material into the core electronic devices.

CO4: Applications of materials in the development of various electronic devices.

CO5: Apply electric and dielectric properties in the area of electromagnetic waves.

CO6: Understand the fundamentals of optical properties and appl ications of nano materials.

UNIT - 1 **L-9**

BONDING AND CRYSTALLOGRAPHY: Bonding forces and energies, Primary inter-atomic bonds, Secondary bonding or van der waals bonding, Fundamental concepts of crystallography, Unit cells, Metallic crystal structures, Polymorphism and allotropy, Crystal systems, Packing densities, Point coordinates, Crystallographic directions, Crystallographic planes, Linear and planar densities, Close-packed crystal structures.

UNIT - 2 **L-9**

SOLID STATE DIFFUSION AND MECHANICAL PROPERTIES: Introduction to diffusion, Diffusion mechanisms, Steady-state diffusion, Nonsteady-state diffusion, Factors that influence diffusion, Diffusion in semiconducting materials, Materials of importance - Aluminum for integrated circuit interconnects introduction to mechanical properties; Concepts of stress and strain, Stress-strain behavior of materials.

UNIT - 3 **L-9**

ELECTRICAL AND DIELECTRIC PROPERTIES: Introduction, Ohm's Law, Electrical conductivity, Electronic and ionic conduction, Energy band structures in solids, Conduction in terms of band and atomic bonding models, Electron mobility, Electrical resistivity of metals, Electrical characteristics of commercial alloys, Intrinsic semiconduction, Extrinsic semiconduction, The temperature dependence of carrier concentration, Factors that affect carrier mobility, The hall effect, Semiconductor devices, Conduction in Ionic materials, Electrical properties of polymers capacitance, Field vectors and types of polarization, Frequency dependence of the dielectric constant, Dielectric strength, Dielectric materials, Ferroelectricity, Piezoelectricity.

UNIT - 4 **L-9**

MAGNETIC PROPERTIES: Introduction to magnetic properties, Basic concepts, Diamagnetism and paramagnetism, Ferromagnetism, Anti-ferromagnetism and ferrimagnetism, The influence of temperature on magnetic behavior, Domains and hysteresis, Magnetic anisotropy, Soft magnetic materials, Materials of importance - An Iron-silicon alloy that is used in transformer cores, Hard magnetic materials, Magnetic storage, Superconductivity.

UNIT - 5 **L-9**

OPTICAL PROPERTIES: Introduction to optical properties, Electromagnetic radiation, Light interactions with solids, Atomic and electronic interactions, Optical properties of metals, Optical properties of nonmetals, Refraction, Reflection, Absorption, Transmission, Color, Opacity and translucency in iInsulators, Luminescence, Materials of importance - Light-emitting diodes, Photoconductivity, Lasers, Optical fibers in communications, Nano materials.

TEXT BOOK:

1. W.D. Callister, "Materials Science and Engineering: an Introduction", 8th edition, Wiley, 2010.

REFERENCE BOOKS:

1. W. F. Smith, "Foundations of Materials Science and Engineering", 5th edition, McGraw Hill, 2015.
2. V. Raghavan, "Materials Science and Engineering", 5th edition, PHI, 2012.

16EC202 ELECTRONIC DEVICES AND CIRCUITS

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course is aimed at offering fundamental concepts of semiconductor devices and circuits. The objective of the course is to introduce the student to Junction Diode, Transistor, FET and other basic devices that are designed with semiconductor materials. As a first-level course in electronics, it forms the basis for the understanding of advanced electronic courses that are offered in subsequent semesters.

Course Outcomes:

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

CO1: Understand the semiconductor devices with the help of V-I characteristics.

CO2: Investigate the characteristics of Amplifier Circuits employing BJT and FET devices.

CO3: Design half wave and full wave rectifiers with and without filters.

CO4: Analyze the working of BJTs and FETs under various biasing conditions.

CO5: Compare CB, CE, CC configurations of BJT and CG,CD,CS configurations of FET.

CO6: Apply the concepts of basic electronic devices to design various circuits.(Lab &MP)

SKILLS :

- ✓ *Identify a Semiconductor Diode for a specific application and power handling capacity.*
- ✓ *Identify the transistor type for a given application (switch/amplifier).*
- ✓ *Recognize the required specifications of the transistor.*
- ✓ *Identify the amplification factor of the given transistor.*
- ✓ *Test the working condition of the transistor.*

ACTIVITIES:

- *Choose a diode for a Cell-phone/ Laptop/ Tablet adapter/ for various ratings.*
- *Design voltage regulator using zener diode.*
- *Design three types of biasing circuits and determine the stability factors in each case.*
- *Transistor as an amplifier for the given specifications.*
- *Design a wideband amplifier with FET.*

UNIT - 1 **L-9**

P-N JUNCTION DIODE: Formation of P-N junction, Energy band diagram of open circuited P-N junction, Operation of forward and reverse biased P-N junction diode, Volt-Ampere characteristics, Temperature dependence on V–I characteristic, Diode resistances and capacitances, Diode equation, Special diodes-Breakdown Mechanisms in a Semi Conductor Diode, Zener diode, V-I characteristics and zener diode as voltage regulator, Tunnel diode, Varactor diode, SCR, LED and photodiode.

UNIT - 2 **L-9**

DIODE APPLICATIONS: The P-N junction diode as a rectifier - Half wave rectifier, Full wave rectifier and bridge rectifier, Harmonic components in a rectifier circuit; Filters - Analysis and comparison of various filters, Inductor filter, Capacitor filter, L- section filter and ð-section filter in terms of ripple factor, A simple regulated power supply circuit; Clipping and clamping circuits - Elementary diode clippers and clamping circuits.

UNIT - 3 **L-9**

TRANSISTOR: Bipolar junction transistor (BJT) - Construction, Principle of operation of PNP and NPN transistors, Characteristics of transistor in common emitter, Common base and common collector configurations; Field effect transistor (FET)-Construction, Symbol and principle of operation of JFET, Pinch-off voltage, JFET characteristics, Comparison of BJT and FET; MOSFET - Construction, working and V-I characteristics of enhancement and depletion MOSFET.

UNIT - 4 **L-8**

BJT and FET BIASING: Transistor biasing and thermal stabilization, DC and AC load lines, Operating point, types of BJT biasing, Thermal runaway and thermal stability, Stabilization against variations in V_{BE}, â and I_{co} , Stability factors, Bias compensation using diodes and transistors **,** Biasing of FET.

UNIT - 5 **L-10**

SINGLE STAGE BJT AND FET AMPLIFIERS: Transistor as an amplifier, Two port network representation and h parameter model of a transistor, Exact and approximate analysis of CE small signal low frequency transistor model, Expressions for voltage gain, Current gain, Input impedance and output impedance using h-parameters, Comparison of transistor amplifier configurations in terms of A_i, R_i, A_v, R_o; FET amplifiers - FET small signal model, Analysis of FET amplifiers (CS, CD and CG configurations) at low frequencies, Expressions for voltage gain, Input impedance and output impedance.

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

1. Understand the V-I characteristics of P-N junction diode and hence determine the diode forward, reverse currents, static and dynamic resistances.
2. Analyze the V-I characteristics of zener diode under reverse biased condition and observe the application as voltage regulator.
3. Calculate the efficiency and ripple factor of all rectifiers and analyze their performance with and without filter.
4. Understand the input and o/p characteristics of all BJT configurations in active region and determine its current amplification factors.
5. Understand the drain and transfer characteristics of FET and determine its amplification factor.
6. Understand the diode application as a clipper.

LIST OF EXPERIMENTS Total hours-30

1. P-N Junction diode characteristics.
2. Zener diode characteristics and Zener diode as Voltage regulator.
3. To determine the ripple factor and efficiency of Half wave Rectifier with and without filter.
4. To determine the ripple factor and efficiency of Center tapped Full wave Rectifier with and without filter.
5. To determine the ripple factor and efficiency of Bridge Rectifier with and without filter.
6. Construction of various diode clipping circuits.
7. Transistor CB characteristics (Input and Output).
8. Transistor CE characteristics (Input and Output).
9. Transistor CC characteristics (Input and Output).
10. FET characteristics.

TEXT BOOKS:

1. J. Millman and C.C.Halkias, "Electronic Devices and Circuits", 9th edition, Tata Mc-Graw Hill, 2012.
2. R.L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits", 9th edition, Pearson/ Prentice Hall, 2006.

REFERENCE BOOKS:

1. J. Taub and C.C. Halkias, "Electronic Circuits", 8th edition, Tata Mc-Graw Hill, 2015.
2. Salivahanan, Kumar and Vallavaraj, "Electronic Devices and Circuits", Tata Mc-Graw Hill, 4th edition, 2008.
3. J. Millman and K Taub, "Electronic Circuits and Applications", 4th edition, Tata Mc-Graw Hill, 2011.
4. K Thomson, "Electronic Switching Circuits", 2nd edition, Oxford University Press, 2012.
5. K Satya Prasad, "Electronic Devices and Circuits", 2nd edition, VGS Publications, 2014.
6. K K Vara Prasad, "Electronic Devices and Applications", 2nd edition, Oxford University Press, 2014.

16EC203 NETWORK THEORY

Hours Per Week :

L	T	P	C
3	1	-	4

Course Description and Objectives:

This course enables the students to learn advanced concepts in circuit analysis which are applicable in solving electronic circuits. The aim of this course to introduce the student to the derivation of transient responses of RC, RL and RLC circuits, steady state response of circuits to sinusoidal excitation in time domain, application of phasors to circuit analysis and introduction to graph theory to analyze circuits.

Course Outcomes:

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

CO1: Apply KVL, KCL, source transformation, star-delta transformation, voltage and current division rules on Electrical networks.

CO2: Investigate series and parallel circuits with AC excitation and resonant circuits.

CO3: Analyze the transient response of RL, RC and RLC circuits for DC and AC excitations.

CO4: Understand the concepts of various network theorems and applying to the linear circuits.

CO5: Analyze the two port network parameters, Interconnect, Represent and analyze two port networks.

CO6: Determine branch currents and voltages using Tieset and cutest.

SKILLS:

- ✓ *Determine currents and voltages of all elements of any electrical system network.*
- ✓ *Analysis of simple house wiring diagram.*
- ✓ *Analysis of simple circuits by using theorems.*
- ✓ *Calculate power, current and voltage in any AC and DC circuits.*
- ✓ *Design of suitable Battery for small applications.*
- ✓ *Application of two- port network parameters to analyze transmission lines and filters.*

UNIT - 1 **L-9, T-3**

INTRODUCTION OF CIRCUIT ELEMENTS: Ideal, Practical and dependent sources and their V-I characteristics, Source transformation, Voltage and current division, V-I characteristics of passive elements and their series / parallel combination, Energy stored in Inductors and capacitors, Kirchhoff's voltage law and Kirchhoff's current law, Mesh and nodal analysis, Star and delta conversions.

UNIT - 2 **L-9, T-3**

SINUSOIDAL STEADY STATE ANALYSIS AND RESONANCE: Instantaneous, Peak, Average ,RMS values, Crest factor and form factor of periodic waveforms, Notation and concept of phasors, Response of R, L, C series and parallel combination circuits to sinusoidal excitation, Calculation of active and reactive powers, Resonance - Series and parallel resonance circuits, concept of bandwidth and Q factor.

UNIT - 3 **L-9, T-3**

NETWORK TRANSIENT ANALYSIS: Transient response of R-L, R-C, R-L-C circuits (Series and parallel combinations) for D.C and sinusoidal excitations, Initial conditions, Time domain and laplace transform methods of solutions.

UNIT - 4 **L-9, T-3**

NETWORK THEOREMS: Superposition theorem, Thevenin's and Norton's theorems, Reciprocity, Compensation, Maximum power transfer theorems, Millman theorem, Application of theorems to DC and AC circuits.

UNIT - 5 **L-9, T-3**

TWO PORT NETWORK PARAMETERS: Introduction to Two port networks, Open circuit impedance and short circuit admittance (Y), Transmission and inverse transmission, Hybrid and inverse hybrid parameters, Relation between parameter sets, Interconnection of two port networks, Graph theory - Definitions, Graph, Tree, Basic tie-set and basic cut set matrices for planar networks, Loop and nodal methods of analysis of networks with independent and dependent voltage and current sources, Duality and dual networks.

TEXT BOOKS:

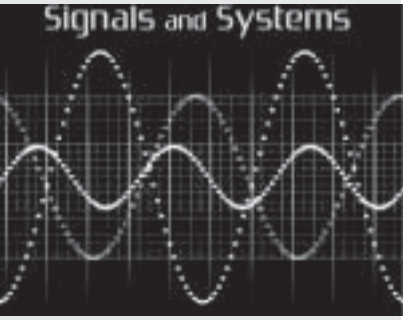
1. William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", 7th edition,Tata McGraw-Hill, 2007.
2. A Sudhakar and Shyammohan S Palli, "Circuits & Networks: Analysis and Synthesis", 5th edition Tata McGraw-Hill, 2007.

REFERENCE BOOKS:

1. Syed A. Nasar, "Electric Circuits", Tata McGraw-Hill, Schaum's Series, 1988.
2. Franklin F.Kuo, "Network Analysis and Synthesis", 2nd Edition, John Wiley and Sons, 2003.
3. Mahmood Nahvi and Joseph Edminister, "Electric Circuits", 4thedition, Schaum's Outline series, Tata McGraw-Hill, 2004.

ACTIVITIES:

- *Measure the Resistance of any resistive Electrical Appliance like water heater, incandescent bulb.*
- *Design of small size house wiring system.*
- *Design circuits with suitable load to get maximum power from source.*
- *Determination of RLC values for given resonant frequency connected series/parallel combination.*
- *Design resonant circuit for oscillator and filter applications.*
- *Design of Power bank for mobile charger circuit.*
- *Determination of Voltage and current characteristics of given Black box.*
- *Verify duality for a given Network.*



16EC204 SIGNALS AND SYSTEMS

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course deals with varoius signals, systems and their analysis along with their applications. The objective of this course is to enable the student to understand the continous time signals, systems and thier properties, analysis of signals using transforms, to analize and predict the behaviour of linear systems.

Course Outcomes:

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

CO1: Understand basic signals andanalyze the representation using Fourier series.

CO2: Analyze continuous time signals by using appropriate mathematical tools like Fourier Transform and Laplace Transform.

CO3: Analyze the response of a LTI System to any arbitrary inputs and learn about signal transmission through linear systems.

CO4: Apply the concepts of convolution and correlation for continuous time signals.

CO5: Understand the fundamentals of sampling including the implications of sampling theorem.

CO6: Work in a team to analyze and demonstrate the applications of signals and systems.

SKILLS:

- ✓ *Design and test a stable system.*
- ✓ *Choose the various transforms and their applications in the analysis of signals and systems.*
- ✓ *Apply transformation to real-world problems involving bio-signals such as EEG, ECG and EMG.*
- ✓ *Analyze the abnormalities present in the physiological systems.*
- ✓ *Choose the desired sampling frequency for a given application.*

UNIT - 1 **L-10**

FOURIER SERIES REPRESENTATION OF PERIODIC SIGNALS: Introduction to signals and systems, Basic signals, Classification, Operations, Vectors vs Signals, Orthogonal functions, Representation of signals using orthogonal functions, Mean square error, Representation of fourier series, Continuous time periodic signals, Properties of fourier series, Dirichlet's conditions, Trigonometric fourier series and exponential fourier series, Complex fourier spectrum.

UNIT - 2 **L-10**

FOURIER TRANSFORMS AND LAPLACE TRANSFORMS: Fourier transforms - Deriving fourier transform from fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, Properties of fourier transforms, Fourier transforms involving impulse function and signum function, Introduction to hilbert transform; Laplace transforms- Review of laplace transforms, Partial fraction expansion, Inverse laplace transform, Concept of region of convergence (ROC) for laplace transforms, Constraints on ROC for various classes of signals, Properties of L.T's, Relation between L.T and F.T of a signal, Laplace transform of certain signals using waveform synthesis.

UNIT - 3 **L-9**

LTI SYSTEMS AND ANALYSIS: Classification of systems, Linear time invariant (LTI) system, Impulse response, Step response, Response of a LTI system to arbitrary inputs, Transfer function of LTI system, Filter characteristics of linear systems, Distortion less transmission, Signal bandwidth, System bandwidth, Ideal LPF, HPF, BPF, BRF characteristics, Causality and paley-wiener criterion for physical realization, Relationship between bandwidth and rise time.

UNIT - 4 **L-9**

CONVOLUTION AND CORRELATION OF SIGNALS: Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Convolution property of fourier transforms, Cross correlation and auto correlation of functions, Properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between auto correlation function and power spectral density, Relation between convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.

UNIT - 5 **L-7**

SAMPLING: Sampling theorem, Graphical and analytical proof for band limited signals, Impulse sampling, Natural and flat top sampling, Reconstruction of signal from its samples, Effect of under sampling - Aliasing; Introduction to band pass sampling.

ACTIVITIES:

- *Recording of various signals like Speech, Noise, Audio signals and analysis using Matlab and spectrum analyzer*

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

- analyze signals in order to calculate their frequency spectra
- analyze the different types of systems and their properties.

LIST OF EXPERIMENTS Total hours-30

1. Generation and plotting of trigonometric and exponential functions.
2. Standard signal teneration (Impulse, Step, Ramp & Sinc).
3. Operations on signals (Folding, Shifting and Scaling).
4. Periodic and Non-periodic signal generation.
5. Analysis of periodic signals.
6. Analysis of Non-periodic signals.
7. Analysis of transfer function.
8. System analysis by using poles and zeros.
9. Sampling theorem verification.
10. System response.
11. Convolution of continuous time signals.
12. Correlation of continuous time signals.
13. Generation of random signals.

TEXT BOOKS:

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, “Signals and Systems”, 2nd edition, Prentice Hall of India, 1997.
2. B.P.Lathi, “Linear Systems and Signals”, 2nd edition, Oxford University Press, 2009.

REFERENCE BOOKS:

1. B.P. Lathi, “Signals,Systems and Communications”, John Wiley, 2005.
2. Simon Haykin and Van Veen, “An Introduction to Signals and Systems”, 2nd edition, Wiley, 2002.
3. John Alan Stuller, “An Introduction to Signals and Systems” Thomson, Indian edition, 2007.
4. H P Hsu, “Signals and Systems”, 2nd edition, Tata McGraw-Hill Schaum’s Outlines, 1995.
5. Tarun Kumar Rawat, “Signals and Systems”, 1st edition, Oxford, 2010.

16EC205 DIGITAL ELECTRONICS

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

Digital Electronics deals with fundamentals of number systems, Boolean expressions that are used to realize combinational and sequential circuits. Its objective is to minimize the logical expressions using Boolean postulates, to design various combinational and sequential circuits and to provide with sufficient number of applications to demonstrate the techniques and mathematics used.

Course Outcomes:

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

CO1: Understand number systems and its conversion; simplify Boolean expressions by different methods and implementation using logic gates.

CO2: Apply the Boolean algebra knowledge of mathematics to analyze combinational and sequential digital electronic circuits using K-map and QM technique.

CO3: Design combinational and sequential circuits for the given specifications/constraints.

CO4: Synthesize the state diagram, state table, state equation for Finite state machine.

CO5: Compare the characteristics of logic families for implementing combinational & sequential circuits.

CO6: Demonstrate applications of digital circuits (lab + minor Project)

SKILLS:

- ✓ *Perform conversions between numbers of different radices.*
- ✓ *Identify the different gates and their properties.*
- ✓ *Minimize Boolean expression.*
- ✓ *Design combinational circuits for a given application.*
- ✓ *Develop sequential circuits for a given application.*
- ✓ *Verify the functionality of digital circuits.*
- ✓ *Design memories for a given specification.*

ACTIVITIES:

- *Choose a Gate for digital circuit.*
- *Design digital circuits using universal gates.*
- *Implement Combinational circuits like adder encoder, decoder.*
- *Design Sequential circuits like flip flops, counters.*
- *Develop Finite state machines like Mealy and Moore machines.*

UNIT - 1 **L-9**

NUMBER SYSTEMS AND BOOLEAN ALGEBRA: Review of number systems- Conversions, Arithmetic operations, Binary codes,Parity code, Hamming code; Fundamental concepts of boolean algebra- Basic theorems and properties, Canonical and standard forms; Logic gates, Algebraic simplification and realization with basic gates and universal gates.

UNIT - 2 **L-9**

MINIMIZATION OF SWITCHING FUNCTIONS: Minimization of switching functions - K-map method, Prime implicants, Don't care combinations, Minimal SOP and POS forms, Tabular method, Prime implicant chart.

UNIT - 3 **L-9**

COMBINATIONAL LOGIC DESIGN: Design using conventional logic gates - Decoder, Encoder, Multiplexer, Demultiplexer, Parity bit generator, code converters (Designing with IC's); Basic PLDs - PAL, PLA, ROM, PROM.

UNIT - 4 **L-10**

SEQUENTIAL LOGIC DESIGN: Classification of sequential circuits, Latches, Flip-Flops - SR, JK, D, T, triggering and Excitation tables; Design of sequential circuits - Shift registers, Counters, FSM, Sequence detectors.

UNIT - 5 **L-8**

LOGIC FAMILIES: Introduction to logic families, CMOS logic, Bipolar logic, Transistor logic, TTL families, CMOS/TTL Interfacing.

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to design different:

- digital circuits.
- combinational circuits.
- sequential circuits.
- FSM for completely specified and incompletely specified sequential machines.
- memories.

LIST OF EXPERIMENTS Total hours-30

Design and Implementation of

1 Basic Logic Gates.
2 Adders.
3 Subtractor.
4 Decoder.
5 Encoder.
6 Multiplexer.
7 De-Multiplexer.
8 Parity Circuits.
9 Comparator.
10 Flip Flops.
11 Registers.

12 Shift Registers.

13 Counters.

14 Finite State Machines (FSM).

TEXT BOOKS :

1. Morris Mano, “Digital Logic and Computer Design”, 1st edition, Pearson, 2013.

2. John F walkerly, “Digital Design Principles and Practices”, 3rd edition, PHI/Pearson Education, 2015.

REFERENCE BOOKS :

1. John M. Yarbrough, “Digital Logic Applications and Design”, 1st edition, Thomson Publications, 2010.

2. Fletcher, “An Engineering Approach To Digital Design”, 1st edition, Prentice Hall of India, 2009.

3. R.P.Jain, “Modern Digital Electronics”, 3rd edition, Tata McGraw–Hill, 2010.

16EC206 PROBABILITY THEORY AND STOCHASTIC PROCESSES

Hours Per Week :

L	T	P	C
3	1	-	4

Course Description and Objectives:

This course deals with the quantifying of randomly varying parameters that are prevalent in real life situations. The objective of the course is to enable the student to learn probability theory and random variables, gain knowledge of multiple random variables, conditional expectation, independence of random variables, analysis of random processes and applications in the communication systems.

Course outcomes:

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

CO1: Understands the basics of probability, sample space, events, statistics and apply them to real life problems.

CO2: Distinguish probability density and distribution functions for single and multiple random variables.

CO3: Calculate the statistical parameters for random variables.

CO4: Analyze the concept of random process along with its parameters.

CO5: Estimate the correlation, covariance and PSD for random processes.

CO6: Analyze the response of linear systems to random inputs.

SKILLS:

- ✓ *Formulate, analyze and validate models applicable to practical problems.*
- ✓ *Use the probability, moment generating functions and characteristic functions.*
- ✓ *Know the multivariate normal law and how to operate jointly with Gaussian random variables.*
- ✓ *Identify the different modes of convergence of sequences of random variables as well as the precise meaning of the laws of large numbers and the central limit theorem.*
- ✓ *Identify probability models based on the theoretical results presented in the course.*

UNIT - 1 **L-9,T-3**

PROBABILITY THEORY AND PROBABILITY STATISTICS: Mean, Median, Mode and Standard deviation, Correlation and regression analysis, Introduction to probability, Joint probability, Conditional probability, Total probability, Bayes' theorem, Bernoulli trails and independent events.

UNIT - 2 **L-9,T-3**

THE RANDOM VARIABLE AND OPERATIONS ON RANDOM VARIABLES: Definition of a random variable, Conditions for a function to be a random variable, Classifications of random variables, Density and distribution functions, Properties of random variables, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional distribution, Methods of defining conditioning event, Conditional density and distribution functions, Properties, Operations on Random variables - Introduction, Expected value of a random variable, Function of a random variable, Moments about the origin, Central moments, Variance, Chebychev's inequality, Characteristic function, Moment generating function, Monotonic transformations for a continuous and discrete random variables.

UNIT - 3 **L-8,T-3**

MULTIPLE RANDOM VARIABLES : Vector random variables, Joint distribution function and its properties, Marginal distribution functions, Conditional distribution and density, Statistical independence, Sum of two Random variables, Central limit theorem.

UNIT - 4 **L-8,T-3**

RANDOM PROCESSES: Temporal characteristics, Random process concept, Classification of processes, Distribution and density functions, Concept of stationary and statistical independence, Wide sense stationary, Time averages and ergodicity, Autocorrelation function and its properties, Cross correlation function and its properties, Gaussian random processes, Poisson random process, Relation between power spectral density and autocorrelation.

UNIT - 5 **L-11,T-3**

LINEAR SYSTEMS WITH RANDOM INPUTS: Random signal response of linear systems, System response – Convolution, Mean and Mean square value, Autocorrelation function; Cross-correlation functions of input and output, Spectral characteristics of system response, Power density spectrum of response, Cross-power density spectrums of input and output, Modeling of noise sources - Resistive (thermal) noise source, Arbitrary noise sources, Effective noise temperature, Average noise figures, Average noise figure of cascaded networks.

TEXT BOOKS:

1. Peyton Z. Peebles, "Probability, Random Variables and Random Signal Principles", 4th edition, Tata McGraw-Hill, 2001.
2. Athanasios Papoulis and S. Unnikrishnan Pillai, "Probability, Random Variables and Stochastic Processes", 4th edition, PHI, 2002.

REFERENCE BOOKS:

1. R.P. Singh and S.D. Sapre, "Communication Systems Analog and Digital", 2nd edition, Tata McGraw Hill, 2009.
2. Henry Stark and John W. Woods, "Probability and Random Processes with Application to Signal Processing", 3rd edition, Pearson Education, 2009.
3. S.P. Eugene Xavier, "Statistical Theory of Communication",1st edition, New Age Publications, 2003.
4. George R. Cooper and Clave D. MC Gillem, "Probability Methods of Signal and System analysis" 3rd edition, Oxford, 1999.
5. Y.Mallikarjuna Reddy, "Probability Theory and Stochastic Process" 4th edition, Universities press, 2015.

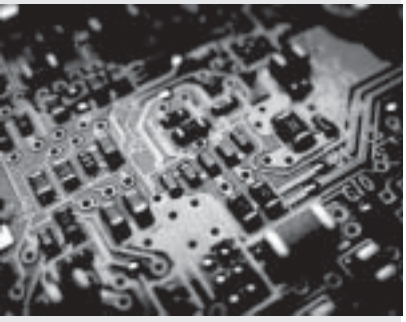
ACTIVITIES:

- *Verify that sum of two random variables is Gaussian.*
- *Write MATLAB code for finding total probability.*
- *Find Expectation, variance and standard deviation with the help of MATLAB for*

  (a) any random data.

  (b) any continuous random variables.

  (c) any discrete random variables.
- *Find Auto Correlation Function and Cross Correlation function for any two random variables.*
- *Plot density and distribution function for any random data.*



16EC207 ELECTRONIC CIRCUIT ANALYSIS

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

The course provides an overview of the principles, operations and applications of the analog building blocks like diodes, BJT, FET etc for performing various functions. The objective of the course is to apply this knowledge to do the analysis and design of basic electronic circuits.

Course Outcome:

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

CO1: Analyze and demonstrate negative feedback amplifier circuits and positive feedback oscillators.

CO2: Understand the working of tuned amplifiers.

CO3: Understand and analyze the different multistage amplifiers.

CO4: Investigate the frequency response of amplifiers.

CO5: Analyze the efficiency of power amplifiers like class-A, B, C, AB.

CO6: Design and verify some common electronic circuits. (Lab and MP)

SKILLS:

- ✓ *Design an amplifier for Public address system.*
- ✓ *Construct an oscillator at audio and Radio frequency applications.*
- ✓ *Design and construct a tuned amplifier in radio receiver.*

UNIT - 1 **L-12**

FEEDBACK AMPLIFIERS AND OSCILLATORS: Concept and types of feedback, Effects of negative feedback, Different topologies with their parameter analysis, Oscillators - Barkhausen's crieterion for oscillations, Frequency of oscillations for Hartley, Colpitts, RC phase shift, Wein bridge and crystal oscillators.

UNIT - 2 **L-10**

MULTI STAGE AMPLIFIERS: Methods of inter stage coupling, N-stage cascaded amplifier, Miller's theorem, Frequency effects, Multistage amplifier analysis - Cascade, Cascode, CE-CC amplifiers, Two stage RC coupled JFET amplifier (CS), High input impedance transistor circuits.

UNIT - 3 **L-8**

FREQUENCY RESPONSE OF AN AMPLIFIER: Transistor at high frequencies, Hybrid-Pi common emitter transistor model, Determination of Hybrid- Pi conductances and capacitances in terms of low frequency h-parameters, Frequency response of BJT amplifiers and FET amplifiers.

UNIT - 4 **L-8**

POWER AMPLIFIERS: Classification of power amplifiers, Operation and efficiency of class A, Class B, Class C and class D amplifiers.

UNIT - 5 **L-7**

TUNED AMPLIFIERS: Concept and types of tuned amplifiers, Single tuned capacitive coupled amplifier, Double tuned amplifier, Stagger tuning, Application of tuned amplifiers, Stability considerations.

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

- apply the knowledge to the analysis and design of basic circuits.
- identify, formulate and solve hardware engineering problems.
- analyze a circuit and compare its theoretical performance to actual performance.

LIST OF EXPERIMENTS Total hours-30

1. Verify negative feedback effects by using voltage shunt feedback topologies.
2. Design Colpitts Oscillator.
3. Verify the cascading Effects on amplifier.
4. Find the frequency response of CE and CS amplifiers.
5. Find the power efficiency of Class-A, B, AB and C amplifiers.
6. Design Single Tuned Amplifier.

TEXT BOOKS:

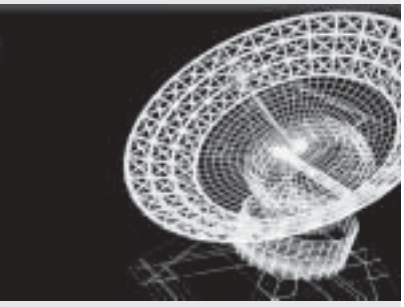
1. J. Millman and C.C. Halkias, "Integrated Electronics", 1st edition, Tata McGraw-Hill, 2009.
2. Donald A. Neaman, "Electronic Circuit Analysis and Design", 3rd edition, Tata McGraw-Hill, 2009.

REFERENCE BOOKS:

1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuits Theory", 9th edition, Pearson/Prentice Hall, 2006.
2. Sedra A.S. and K.C. Smith, "Micro Electronic Circuits", 5th edition, Oxford University Press, 2006.
3. M.H. Rashid, "Micro Electronic Circuits: Analysis and Design", 1st edition, Thomson PWS Publ, 1999.

ACTIVITIES:

- *Bandwidth improvement using negative feedback.*
- *Designing 1 Hz frequency oscillator for digital clock.*
- *calculating overall gain in multi stage amplifier.*
- *Design Music Operated Dancing LEDs.*
- *To determine overall bandwidth of multistage amplifiers.*
- *Design Microphone amplifier.*
- *To observe the crossover distortion and its elimination.*
- *Designing Water Tank Overflow alarm circuit using Darlington pair.*
- *Designing Rain Detector and Alarm Circuit using Darlington pair.*
- *Designing 25W audio power amplifier.*



16EC208 ANALOG COMMUNICATIONS

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course deals with the fundamentals of analog communications - amplitude modulation and demodulation, frequency modulation and demodulation, phase modulation and demodulation. The objective of this course is to enable the students to understand the basic mathematical concepts of communications in both time domain and frequency domain.

Course Outcomes:

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

CO1: Understand the concepts of modulation, demodulation and learn the basic amplitude modulation techniques.

CO2: Analysis of DSB-SC, SSB-SC and VSB-SC modulation and demodulation techniques.

CO3: Analyze the performance of different types of Angle Modulation Techniques for a given set of parameters.

CO4: Identify the transmitter and receiver types required for a given application.

CO5: Understand the calculation of SNR in different modulation techniques.

CO6: Experiment on different types of Analog communication subsystems using hardware and simulations.

SKILLS:

- ✓ *Identify the need for modulation and choice of modulation.*
- ✓ *Choose the choice of frequency bands of AM/FM/T.V/Mobile/Satellite.*
- ✓ *Select base band signal, carrier and modulated signals in a given application.*
- ✓ *Determine the frequency deviation/guard band for FM receiver.*
- ✓ *Identify the Tx/Rx type required for a given application.*
- ✓ *Select the detector/discriminator required in FM.*
- ✓ *Identify inherent or interference noise and classify.*

UNIT - 1 **L-9**

INTRODUCTION TO COMMUNICATION SYSTEM: Introduction to communication system, Need for modulation, Frequency division multiplexing, Amplitude modulation- Definition, Time domain and frequency domain description, Single tone modulation, Power relations in AM waves; Generation of AM waves - Square law modulator, Switching modulator; Detection of AM waves- Square law detector, Envelope detector.

UNIT - 2 **L-10**

DSB-SC, SSB-SC AND VSB-SC MODULATION AND DETECTION: DSBSC modulation, Time domain and frequency domain description, Generation of DSBSC waves - Balanced modulators, Ring modulator; Detection of DSBSC waves - Coherent detection, COSTAS loop; SSB modulation,Time domain description, Frequency domain description, Generation of SSB Waves -Frequency discrimination method, Phase discrimination method; Demodulation of SSB Waves, VSB modulation, Frequency description, Time domain description, Generation of VSB modulated wave, Envelope detection of a VSB wave plus carrier, Comparison of AM techniques, Applications of different AM systems.

UNIT - 3 **L-10**

ANGLE MODULATION SYSTEMS: Angle modulation - Phase and frequency modulation and their relationships, Phase and frequency deviation, Spectrum envelope of FM signal, Narrow band FM and wide band FM, Transmission bandwidth; Generations of FM waves, Indirect and direct methods, Detection of FM waves - Balanced frequency discriminator, Foster seely discriminator, PLL demodulator.

UNIT - 4 **L-8**

RADIO TRANSMITTERS AND RECEIVERS: Radio transmitters - Classification of radio transmitters, AM transmitters and FM transmitters, Variable reactance type and phase modulated type; Radio receivers - Radio receiver types, TRF receiver, Super heterodyne receivers, FM receivers; Comparison of AM and FM receivers.

UNIT - 5 **L-8**

NOISE: Noise in analog communication system, Noise in DSB and SSB system, Noise in AM system, Noise in angle modulation system, Threshold effect in angle modulation system, Pre-emphasis and de-emphasis.

ACTIVITIES:

- *Choose the modulation scheme for the given Audio signal with minimum bandwidth.*
- *Choose the modulation scheme for the given voice signal with very good quality.*
- *Design simple AM modulator using discrete components.*
- *Design a VCO (NE 566) to generate FM signal for a given application.*
- *Design the scheme for demonstrating the capturing effect of FM receiver.*

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

- identify and describe different analog modulation techniques.
- analyze AM radio transmitter and receiver.
- use AM techniques in MATLAB simulink.

LIST OF EXPERIMENTS Total hours-30

1. Amplitude Modulation and Demodulation.*
2. DSB-SC Modulation and Demodulation.*
3. SSB-SC Modulation and Demodulation.*
4. Frequency Modulation and Demodulation.
5. Pre-Emphasis and De-Emphasis.
6. Verification of Sampling Theorem.

7. Phase Locked Loop.
8. Design of Mixer.
9. AGC Characteristics.
10. Frequency Division Multiplexing.

** To be performed both in hardware and software (Simulink).*

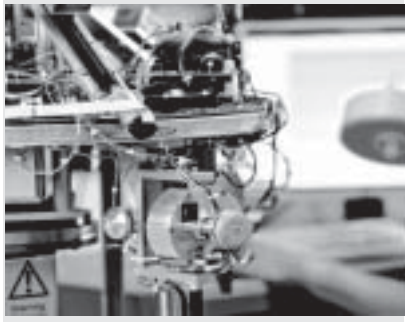
TEXT BOOKS:

1. H Taub, D.L. Schilling and Goutam Saha, “Principles of Communication Systems”, 3rd edition, TMH, 2008.
2. G.K. Mithal, “Radio Engineering Principles of Communication systems”, 20th edition, Khanna Publishers, 2008.

REFERENCE BOOKS:

1. B.P.Lathi, “Modern Digital and Analog Communication Systems”, 3rd edition, Oxford University Press, 2007.
2. B.Sklar, “Digital Communications Fundamentals and Applications”, 2nd edition, Pearson Education, 2007.
3. H P Hsu, “Analog and Digital Communications”, Schaum Outline Series, TMH, 2006.
4. Leon W. Couch, “Digital and Analog Communication Systems”, 8th edition, Pearson, 2013.

16EC209 LINEAR CONTROL SYSTEMS



Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

This course enables applications of mathematical modeling of physical systems (electrical, mechanical, chemical, thermal and pneumatic systems) and presents different methods of analysis and design. The aim of this course is to provide the knowledge in various time and frequency domains, tools for analysis and design of linear control systems and compensators.

Course Outcomes:

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

CO1: Calculate the transfer function of different control systems.

CO2: Apply mathematical modeling to the physical systems/electrical systems.

CO3: Understand and analyze the characteristics of feedback systems.

CO4: Analyze the response of the open and closed loop systems with time domain and state space analysis. CO5: Design lag, lead and lead-lag compensators and PID controllers.

CO6: Investigate the stability of a given control system by using RH, Root locus, Bode plot and Nyquist plot.

SKILLS:

- ✓ *Model any physical system (Electrical, Mechanical, Electro-mechanical).*
- ✓ *Determine overall transfer function of a system using block diagram reduction technique and SFG method.*
- ✓ *Analyze first and second order systems in time domain.*
- ✓ *Determine design specifications like rise time, settling time, steady state error.*
- ✓ *Analysis of stability using R-H Criterion.*
- ✓ *Determine open loop gain variation in a stable system using root locus method.*
- ✓ *Stability analysis of any system in the frequency domain.*
- ✓ *Design of lag, lead compensators using R, L and C for any linear time invariant system.*

ACTIVITIES:

- *Realize the Lag, Lead Compensators using R,L and C for any specifications.*
- *Analyze time response of second order system using MATLAB.*
- *Analyze LTI system for stability using MATLAB.*
- *Design PID controller.*

UNIT - 1 **L-11**

INTRODUCTION TO CONTROL SYSTEMS: Introduction, Concept of control systems, Open loop versus closed loop control systems, Different examples of control systems, Classification of control systems, Mathematical Models of Physical Systems, Differential equations, Transfer function and block diagram representation of systems considering electrical systems as examples, Block diagram algebra, Signal flow graph representation, Reduction using Mason's gain formula, Translational and rotational mechanical systems.

UNIT - 2 **L-6**

FEED-BACK CHARACTERISTICS AND CONTROL COMPONENTS: Feedback, Effects of feedback, Control over system dynamics by the use of feedback, Elements of control systems, Transfer function derivation of DC Servo motor, AC servo motor, Synchro transmitter and receiver.

UNIT - 3 **L-9**

TIME RESPONSE ANALYSIS AND STABILITY: Time response analysis, Standard test signals, Time response of first order systems, Characteristic equation of feedback control systems, Transient response of second order systems, Time domain specifications, Steady state response, Steady state errors and error constants, Stability - The concept of stability, Routh stability criterion.

UNIT - 4 **L-10**

RL TECHNIQUE AND FREQUENCY RESPONSE ANALYSIS: Root locus technique - The root locus concept, Construction of root loci; Frequency response analysis - Introduction, Frequency domain specifications, Bode diagrams, Determination of frequency domain specifications from the Bode diagram, Phase margin and gain margin, Stability analysis from Bode plots, Polar plots, Nyquist plots and Nyquist stability criterion.

UNIT - 5 **L-9**

DESIGN AND MODERN CONTROL SYSTEMS: The design problem, Preliminary design considerations, Realization of basic compensators - Lead, Lag and Lead-lag; PID controllers, State space analysis of continuous systems - Concepts of state, State variables and state model, Derivation of state models from block diagrams, Solving the time invariant state equations, State transition matrix, Controllability and observability.

TEXT BOOKS:

1. I. J. Nagrath and M. Gopal, "Control Systems Engineering", 2nd edition, New Age International (P) Limited, 2009.
2. Katsuhiko Ogata, "Modern Control Engineering" 5th edition, Prentice Hall of India Private Ltd, New Delhi, 2011.

REFERENCE BOOKS:

1. M. Gopal, "Control Systems: Principles and Design", 3rd edition, McGraw Hill, 2008.
2. Benjamin C Kuo and Farid Golnaraghi, "Automatic Control systems", 9th edition, Prentice Hall of India PrivateLtd, New Delhi, 2009.
3. Richerd C. Dorf and Robert H. Bishop, "Modern Control Systems", 12th edition, Prentice, Hall, 2010.
4. S.Salivahanan, R.Rengaraj and G.R. Venkata Krishnan, "Control Systems Engineering", 1st edition, Pearson, 2015.

16EL102 SOFT SKILLS LABORATORY

Hours Per Week :

L	T	P	C
-	-	2	1

Course Description and Objectives:

The Soft Skills Laboratory course is aimed at training undergraduate students on employability skills. Designed to impart work related skills, the course will enable trainees to develop interpersonal communication, leadership, preparing resumé, group discussion and interview skills. It will give them the required competence and confidence to handle professional tasks.

Course Outcomes:

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

CO1: Have the ability to introspect on individual strengths and weaknesses, and emerge as a balanced personality with improved self-awareness and self-worth.

CO2: Be able to prepare a resume and gain the confidence to face an interview.

CO3: Develop interpersonal skills to participate himself/herself effectively in everyday professional and social contexts.

CO4: Be able to implement professionalism into his/her daily activities.

CO5: Adapt gender sensitive language and workplace etiquette in his/her professional life.

SKILLS:

- ✓ *Communicate and understand the difference between soft skills and hard skills.*
- ✓ *Professionalism and employability skills.*
- ✓ *Plan career by drawing their SWOT, setting the goal, learn the importance of time and stress management.*
- ✓ *Vocabulary, situational english, group discussion, reading comprehension and listening comprehension which are essential for all competitive examinations.*
- ✓ *Prepare resumé and learn how to face interview.*
- ✓ *Gender sensitive language, good manners, emotional intelligence and essential skills.*

ACTIVITIES:

- *Formal and informal communication.*
- *SWOT analysis.*
- *Stephen covey Time Management matrix.*
- *Stress Management techniques.*
- *Vocabulary flash cards.*
- *Situational Dialogues.*
- *Group Discussion.*
- *Resume preparation.*
- *Mock Interview.*
- *Reading comprehension activities.*
- *Listening comprehension Activity by watching the American accent video.*
- *Emotional intelligence, etiquette quiz.*

UNIT - 1 **P-8**

A) COMMUNICATION: Need for effective communication - The process of communication, Levels of communication, Flow of communication, Choice of diction and style with reference to setting (formal, semi-formal or informal); Communication networks, Barriers to communication, Miscommunication, Noise and ways to overcome the barriers.

B) SOFT SKILLS: Difference between soft and hard skills, Need for soft skills, Professionalism, Employability skills.

C) CAREER PLANNING: Job vs career, Goal setting, SWOT analysis, Planning and prioritization, Four quadrant time management system, Self-management, Stress-management.

ACTIVITY: Johari Window for SWOT analysis, Setting a SMART goal using the provided grid, Writing a statement of purpose (SOP).

UNIT - 2 **P-8**

A) VOCABULARY BUILDING: Word etymology, Roots, Prefixes and suffixes, Synonyms and antonyms, Collocations, One-word substitutes, Analogies, Idioms and phrases, Contextual guessing of unfamiliar words, Task-oriented learning (50 words).

ACTIVITY: Making a flash card (one per day by each student), Vocabulary exercises with hand-outs, Vocabulary quiz (evaluation will be a combination of the 50 words provided by the instructor and the flash cards made by the student (one per day).

B) FUNCTIONAL ENGLISH: Situational dialogues, Role plays (including small talk), Self introduction, Opening and closing a telephonic conversation, Making an appointment, Making a query, Offering/ Passing on information, Communicating with superiors, Expressing agreement/objection, Opening bank account (combination of prepared and impromptu situations given to each student).

C) GROUP DISCUSSION: Articulation and flow of oral presentation, Dynamics of group discussion, Intervention,Summarizing and conclusion, Voice modulation, Content generation, Key word approach (KWA), Social, Political, Economic, Legal and technical approach (SPELT), View point of affected part (VAP), Language relevance, Fluency and coherence.

ACTIVITY: Viewing a recorded video of GD and Mock sessions on different types of GD topics - Controversial, Knowledge, Case study (including topics on current affairs).

UNIT - 3 **P-4**

A) RESUME-WRITING: Structure and presentation, Defining career objective, Projecting one's strengths and skill-sets, Summarizing, Formats and styles and covering letter.

ACTIVITY: Appraising some samples of good and bad resumes, Preparing the resume, Writing an effective covering letter.

B) FACING INTERVIEWS: Interview process, Understanding employer expectations, Pre-interview planning, Opening strategies, Impressive self-introduction, Answering strategies, Other critical aspects such as body language, Grooming, Other types of interviews such as stress-based interviews, Tele-interviews, Video interviews, Frequently asked questions (FAQs) including behavioural and HR questions and the aspect looked at by corporate during interviews.

ACTIVITY: Writing responses and practicing through role plays and mock interviews on the FAQs including feedback.

UNIT - 4 **P-4**

A) READING COMPREHENSION: Reading as a skill, Techniques for speed reading, Understanding

the tone, Skimming and scanning, Appreciating stylistics, Impediments for speed reading, Eye fixation, Sub-vocalization, Critical reading, Reading based on purpose, Reading for information, Reading for inference.

ACTIVITY: Reading comprehension exercises with texts drawn from diverse subject areas (Hand-outs), Newspaper activity with students divided into 4 groups, Each group looks at critical component of communication such as Listening, Speaking, Reading and writing enabling them to be better communicators as well as be more aware about the current affairs, Which help in group discussion.

B) LISTENING COMPREHENSION: Listening as a skill, Different types of listening, Active and passive listening, Top-down approach, Bottom-up approach, Understanding the non verbal cues of communication, Intonation and stress.

ACTIVITY: Narration of a story, Speech excerpts with different accents (Indian, British, American), listening comprehension exercises with audio and video excerpts.

UNIT - 5 **P-6**

IMPACT OF LANGUAGE ON PERSONALITY: Gender sensitive language in MNCs, Cultural sensitivity, Social awareness, Emotional intelligence, Good manners, Self-grooming, Positive body language, Accepting and handling responsibility, Assertiveness, Problem solving, Negotiating skills, Networking and creating a good first impression, Seven essential skills for a team player, Attentive listening, Intelligent questioning, Gently persuading, Respecting other's views, Assisting others, Sharing, Participating actively.

ACTIVITY: Johari Window, Games and case studies.

REFERENCE BOOKS:

1. Edward Holffman, "Ace the Corporate Personality", McGraw Hill,2001.
2. Adrian Furnham, "Personality and Intelligence at Work", Psychology Press, 2008.
3. John Adair Kegan Page, "Leadership for Innovation", 1st edition, Kogan, 2007.
4. M.Ashraf Rizvi, "Effective Technical Communication", 1st edition, Tata McGraw Hill, 2005.
5. Krishna Mohan and NP Singh, "Speaking English Effectively", 1st edition, Macmillan, 2008.
6. Soft Skills Material of Infosys Under the Academic Initiative of Campus Connect.
7. Dr. S.P. Dhanvel, "English and Soft Skills", Orient Blackswan, 2011.
8. Rajiv K. Mishra, "Personality Development", Rupa and Co, 2004.

III

YEAR

ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.

I SEMESTER

- 16EC301 - Linear IC's and Applications
- 16EC302 - Microprocessors and Microcontrollers
- 16EC303 - Digital Communications
- 16EC304 - Electromagnetic Waves and Transmission lines
- 16EL103 - Professional Communication Lab
- - Department Elective
- - Department / Open Elective
- - Employability and Life Skills Elective

II SEMESTER

- 16HS301 - Professional Ethics
- 16EC305 - Computer Architecture and Organization
- 16EC306 - VLSI Design
- 16EC307 - Antenna Propagation
- 16EC308 - Digital Signal Processing
- - Department Elective
- - Department / Open Elective
- - Employability and Life Skills Elective

COURSE CONTENTS

I SEM & II SEM

16EC301 LINEAR IC's AND APPLICATIONS

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course introduces theoretical aspects and circuits of Operational-Amplifier (Op-Amp), timers, PLLs, Voltage Regulators and OTAs, which are essential building blocks of linear integrated circuits. The objective of the course is to introduce the various linear and non-linear applications of Op-Amp and others.

Course Outcomes:

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

CO1: Understand the characteristics and specifications of operational amplifiers.

CO2: Analyze operational amplifiers based circuits used for various applications.

CO3: Design various types of filters and regulators using operational amplifiers.

CO4: Understand and analyze the operation and applications of timer, phase locked loop and voltage controlled oscillators.

CO5: Understand data converters and OTA.

CO6: Design and verify some common electronic circuits using linear ICs. (Lab &MP)

SKILLS:

- ✓ *Analyze and design Waveform Generators / Oscillators.*
- ✓ *Design Multivibrators for a given application.*
- ✓ *Develop Voltage Regulators for a given specification.*
- ✓ *Design Modulators like PWM, PPM, FSK.*
- ✓ *Implement Data converters.*
- ✓ *Design Frequency Synthesizers.*

ACTIVITIES:

- *Design inverting amplifier and voltage follower used in Buffers.*
- *Design Integrator, used in ADC's and Wave form generators.*
- *Develop RC phase shift oscillator using Op-Amp.*
- *Design Active Low pass Filters, used in Radio Transmitters.*
- *Implement Monostable Multivibrator.*

UNIT - 1 **L-9**

FUNDAMENTALS OF LINEAR ICs: Differential DC amplifier, Common mode analysis, Differential mode analysis, CMRR, Constant current source in place of R_E, Design of a differential DCamplifier using bipolar transistors, 741 operational amplifier, Ideal and practical characteristics, Inverting and non-inverting configurations, Summing amplifier, Difference amplifier.

UNIT - 2 **L-9**

APPLICATIONS OF OPERATIONAL AMPLIFIERS: Op-Amp as - Instrumentation amplifier, Integrator and lossy integrator, Differentiator and practical differentiator, Logarithmic amplifier, Astable-multivibrator, Monostable multivibrator, Comparators and schmitt trigger, RC phase shift and wien bridge oscillators.

UNIT - 3 **L-9**

ACTIVE FILTERS AND REGULATORS: Application of Op-Amp as active filter, Butterworth first and second order filters, Low pass, High pass, Band pass and band reject filters, Design of practical filters, 3-terminal regulators, LM723 regulator.

UNIT - 4 **L-9**

TIMER AND PLL: Functional diagram of 555 timer, Timer as astable and monostable multivibrators, Timer as FSK generator, Voltage controlled oscillator (VCO), Phase lock loop (PLL), Capture range, Lock range, PLL 565 and applications.

UNIT - 5 **L-9**

DATA CONVERTER AND OPERATIONAL TRANS-CONDUCTANCE AMPLIFIER(OTA): Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R ladder DAC, Parallel comparator ADC, Successive approximation ADC and dual slope ADC, Characteristics of A/D and D/A converters. Basic configuration of an OTA, OTA applications.

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

- demonstrate the use of analog circuit analysis techniques to analyze the operation and behavior of various analog integrated circuits.
- design linear active filters and regulators.
- design timer based oscillators.

LIST OF EXPERIMENTS Total hours-30

1. Op-Amp as non Inverting amplifier (LM 741).
2. Op-Amp as adder and subtractor (LM 741).
3. Op-Amp as Differentiator (LM 741).
4. Function Generator using 741 Op-Amp.
5. Active Filters –HPF (first order).
6. IC 555 Timer as Astable Multivibrator.
7. IC 741 Op-Amp as D/A Converter.
8. Regulator experiments need to be add(78XX /79XX series).
9. PLL Experiments (565 series).
10. VCO experiments (566 series).

TEXT BOOKS:

1. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th edition, PHI, 2009.
2. G.B.Clayton, "Operational Amplifiers", 5th edition, Butterworth, 1971.

REFERENCE BOOKS:

1. Tahira Parveen, "Operational Transconductance Amplifier and Analog Integrated Circuits", I K International Publishing House Pvt.Ltd, 2010.
2. D. Roy Choudhury, "Linear Integrated Circuits", 4th edition, New Age International (p) Ltd, 2014.
3. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd edition, McGraw Hill,1988.
4. Millman, "Micro Electronics", 4th edition, McGraw Hill, 2009.

16EC302 MICROPROCESSORS AND MICROCONTROLLERS

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

Thi s course i ntroduces basi c archi tecture and operati on of a mi croprocessor and a microcontroller to the student. The course objective is to study the architecture and addressing modes of 8086/8051 and to know the importance of different peripheral devices and their interfacing with 8086/8051.

Course Outcomes:

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

CO1: Understand and analyze the architectures of 8086 microprocessors and 8051 micro controllers.

CO2: Identify various peripheral interfaces to 8051:

CO3: Understand the architecture of ARM Processor.

CO4: Create basic assembly language programs for 8086, 8051 and ARM processors.

CO5: Experiment to interface various peripherals to 8051:

CO6: Develop applications based on different processors and controllers.

SKILLS:

- ✓ *Identify a Microcontroller for a specific application.*
- ✓ *Design a Microprocessor based system.*
- ✓ *Design a Microcontroller based system.*
- ✓ *Do programming in assembly language.*

UNIT - 1 **L-9**

INTRODUCTI ON TO 8086 MI CROPROCESSOR: Evol ut i on of miroprocessors; 8086 micro processorArchitecture, Register model, Memory segmentation, Physical address generation, Addressing modes, Instruction set, Interrupts of 8086. Pin configuration of 8086; 8086 system bus architecture, Physical Memory organization.

UNIT - 2 **L-9**

INTRODUCTION TO 8051 MICROCONTROLLER: Comparing Microprocessors and icrocontrollers; 8051 Micro controller Architecture; Signal Description of 8051; Memory organization; Addressing modes of 8051; Instruction set; Assembly language program examples in 8051.

UNIT - 3 **L-9**

8051 MICROCONTROLLER HARDWARE AND PERIPHERAL INTERFACING: Parallel Ports in 8051; 8051 Timers; 8051 Serial ports; 8051 Interrupts**.**

Peripheral Interfacing- LCD and Keyboard Interfacing, ADC and Sensor Interfacing, DC Motor and Stepper Motor Interfacing Techniques.

UNIT - 4 **L-9**

IARM ARCHITECTURE : RISC Vs CISC systems – ARM Philosophy – ARM7TDMI Core Architecture – Functional Diagram – Programmer's Model – ARM State Register Set –THUMB state register set –Current Program Status Register – ARM 7TMI Operating modes – mode bits – Exceptions – Interrupt Vector Table – Interrupt Processing.

UNIT - 5 **L-9**

ARM INSTRUCTION SET : ARM Assembly Language – Instruction Syntax – ARM Instruction Set – Data processing, Branch, Load/Store Instructions. Miscellaneous Instructions.

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

- understand microprocessor types and programming of them.
- understand interfacing circuits necessary for different applications.
- design a system, component or process as per needs and specifications.
- apply the programming techniques in designing simple assembly language programs for solving simple problems by using instruction sets of microprocessor and microcontroller.

LIST OF EXPERIMENTS Total hours-30

1. Programs on different data transfer instructions using 8086.
2. Arithmetic operations - Addition, Subtraction, Multiplication and division.
3. Logical conversions - BCD to Hex, Hex to BCD, Hex to ASCII, ASCII to BCD.
4. Finding Arithmetic mean of given numbers.
5. Finding Sum of Squares, Cubes of given numbers.
6. Searching for Minimum, Maximum of given numbers.
7. Sorting given string in Ascending, Descending order.
8. String operations - Moving, Reversing, Comparing.
9. Programs on Data Transfer Instructions using 8051.

ACTIVITIES:

- *Interface a 16x2 LCD with 8051.*
- *Interface a 4X4 Hex keypad with 8051.*
- *Interface Stepper motor.*
- *Interface DAC, To generate Square and Triangular waves.*
- *Interface ADC, To convert analog signal to digital and to display it in 7-segment LED display.*
- *With the help of timer units in 8051 Count external pulses arriving on port pins.*
- *Design any microcontroller based system with more than seven peripherals.*

10. With different addressing modes carry out all arithmetic operations (use appropriate simulator for ex C51 keil simulator).
11. Searching for Minimum, Maximum of given numbers.
12. Sorting given string in Ascending, Descending order.
13. Make a Port Pin as input and other pin as output, whatever input is applied it has to appear on output port.
14. Generate time delays using Timers in mode0, mode1 and mode2 use polling method.
15. Generate time delays using Timers in mode1 use interrupt method.

TEXT BOOKS:

1. Douglas V.Hall, “Microprocessors and Interfacing”, 2nd edition, Tata McGraw Hill, 2006.
2. Kenneth J. Ayala, “The 8051 Microcontroller”, 3rd edition, Cengage Learning India Pvt. Ltd, 2008.

REFERENCE BOOKS :

1. Barry B. Brey, “The Intel microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, Pentium Pro processor, Pentium II, Pentium III, Pentium 4, and Core2 with 64-bit extensions:architecture, programming, and interfacing”, 8th edition, Pearson Prentice Hall, 2009.
2. Mohamed Rafiquzzaman, “Microprocessors and Microcomputer Based System Design”, 2nd edition, CRC Press, 2007.

16EC303 DIGITAL COMMUNICATIONS

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course offers the fundamental, theoretical and practical concepts of digital communication systems. The objective of the course is to introduce the concepts of digital communication system and its advantages, theoretical aspects of waveform coding techniques and digital modulation techniques, basics of information theory, source coding and Error-control coding.

Course Outcomes:

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

CO1: Understand the models of digital communication systems and Information theory.

CO2: Describe and analyze digital pulse modulation techniques.

CO3: Analyze digital modulation schemesand understand the reception of digital signal.

CO4: Apply error control coding techniques for efficient communication.

CO5: Understand basic multiple access techniques for communications.

CO6: Experiment on different types of digital communication subsystems using hardware and simulationsfor a given application / problem statement. (Lab)

SKILLS:

- ✓ *Design TDM.*
- ✓ *Develop pulse generators for given specification.*
- ✓ *Implement ADC, DAC techniques.*
- ✓ *Mathematical analysis of the digital modulated signals.*
- ✓ *Realize 8-PSK, 16-PSK and 32-PSK.*
- ✓ *Design SEC-DED coders.*

ACTIVITIES:

- *Implement different Digital modulation schemes using Matlab.*
- *ON-OFF Keying used in optical communication.*
- *Design M-ary technique for PSK using Matlab.*
- *Demonstrate different digital communications system blocks in Radio and TV.*

UNIT - 1 **L- 9**

ELEMENTS OF DIGITAL COMMUNICATION SYSTEMS AND BASICS OF INFORMATION THEORY : Elements of Digital Communication Systems: Model of Digital Communication Systems, Advantages of Digital Communication Systems.

BASICS OF INFORMATION THEORY: Information and entropy, Source Coding Theorem, Lossless Data Compression Algorithms- Huffman coding, Shannon-Fano coding, Mutual Information, Channel Capacity, Channel-coding Theorem, Information Capacity Law, Implications of the Information Capacity Law.

UNIT - 2 **L-9**

BASEBAND PULSE TRANSMISSION: Pulse Analog Modulation-Introduction to Pulse Amplitude Modulation (PAM), Pulse Width Modulation (PWM) and Pulse Position Modulation (PPM), Time Division Multiplexing, Pulse Code Modulation - Elements of PCM, Sampling, Quantization Process, Uniform and Non-uniform Quantization (companding), Quantization error, SNR, encoding, Different formats of encoding, Differential PCM systems (DPCM). Delta Modulation, draw backs of DM, Adaptive Delta Modulation, comparison of PCM and DM systems

UNIT - 3 **L-9**

MODULATION TECHNIQUES AND OPTIMAL RECEPTION OF DIGITAL SIGNAL: Digital Modulation Techniques - Introduction, ASK, FSK, PSK, DPSK, QPSK and QAM. Optimal Reception of Digital Signal – Base band signal receiver, matched filter,

UNIT - 4 **L-9**

ERROR CONTROL CODING: Linear Block codes- Introduction, Error detection and error correction capabilities of linear block codes, single error correcting hamming codes. Binary cyclic codes-encoding, syndrome calculation, Error detection and Error correction capabilities of cyclic codes. Convolution Codes- Introduction, encoding of convolution codes, Code tree, trellis diagram, decoding using Viterbi algorithm.

UNIT - 5 **L-9**

MULTIPLE ACCESS TECHNIQUES: Basics of TDMA, FDMA and CDMA, Spread Spectrum Modulation: Use of Spread Spectrum, Direct Sequence Spread Spectrum (DSSS), Code Division Multiple Access, Ranging using DSSS. Frequency Hopping Spread Spectrum, PN - sequences: Generation and Characteristics. Synchronization in Spread Spectrum Systems, Timing and frequency synchronization,

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

- understand practical aspects of TDM.
- understand practical aspects of pulse analog modulations and Pulse digital modulations.
- observe digital modulation techniques.
- know the practical aspects of cyclic and convolutional encoder.

LIST OF EXPERIMENTS Total hours: 30

I. HARD WARE

1. Time Division Multiplexing.
2. PAM.
3. PPMand PWM.

4. Pulse Code Modulation.
5. Delta Modulation.
6. Amplitude Shift Keying.
7. Frequency Shift Keying.
8. Phase Shift Keying.
9. Differential Phase Shift Keying.

II. SOFT WARE

(i) MATLAB

1. Companding Laws.
2. Huffman Coding.
3. Convolutional Encoder/Decoder.

(ii) SIMULINK/ VSG & VSA Setup

1. FSK Modulation and Demodulation.
2. BPSK Modulation and Demodulation.
3. QPSK Modulation and Demodulation.
4. 16-QAM Modulation and Demodulation.

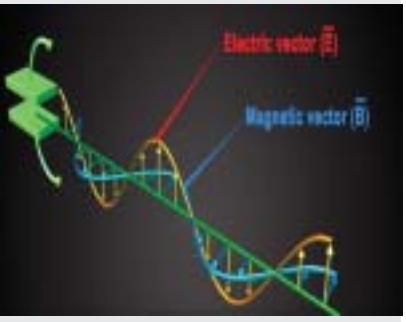
Note : Any 12 expriments from the above list.

TEXT BOOKS:

1. Simon Haykin, "Digital communications", 2nd edition, John Wiley, 2014.
2. Simon Haykin, Michael Moher, "Introduction To Analog And Digital Communications", 2nd edition, Wiley, 2007.
3. William Stallings" Wireless Communications and Networks" 2nd edition, Pearson Edecation, 2009.

REFERENCE BOOKS:

1. Principles of Communication Systems – Herbert Taub, Donald Schilling, GoutamSaha, 3rd Edition, McGraw-Hill, 2008
2. Digital and Analog Communication Systems – Sam Shanmugam, John Wiley, 2005
3. Digital Communications- John G. Proakis, MasoudSalehi - 5th Edition, McGraw-Hill, 2008
4. Communication Systems, Simon Haykin, Michael Moher, 4th edition, Wiley, 2007



16EC304 ELECTROMAGNETIC WAVES AND TRANSMISSION LINES

Hours Per Week :

L	T	P	C
3	1	-	4

Course Description and Objectives:

This course offers the fundamental knowledge of electro magnetic fields involving in various engineering applications. It gives the foundation in electromagnetism and its use in modern communication areas such as wired and wireless. The objective of the course is to enable the student familiarise with the propagation of low and high frequency signals through transmission lines and free space.

Course Outcomes:

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

CO1: Discussthe various electromagnetic quantities in spatial distribution by various co-ordinate systems.

CO2: Understand the concepts of electric field intensity and electric flux density due to various charge distributions and applications of Gauss's law.

CO3: Analyze the magneto-static for charge distributions and boundary conditions.

CO4: Explain the Maxwell's Equations in integral and differential form.

CO5: Illustrate the concepts of electro-magnetic wave propagation, wave characteristics and poynting theorem.

CO6: Analyze the characteristics of transmission lines and solve the parameters using smith chart.

SKILLS:

- ✓ *Follow the path of electric field lines for a given regular geometric source.*
- ✓ *Classify the given material as linear, isotropic or homogeneous.*
- ✓ *Draw the magnetic flux lines for the given magnetic source.*
- ✓ *Calculate the emf and hence the inductance offered by coil.*
- ✓ *Use the wave equation to determine the field in various media.*
- ✓ *Consolidate the power conservation in electromagnetic waves.*
- ✓ *Identify the required dimensions of the transmission line for the given specifications.*
- ✓ *Calculate the matching transmission line parameters for the mismatched load.*

UNIT - 1 **L-9, T-3**

ELECTROSTATIC FIELDS: Review of coordinate systems and vector analysis, Coulomb's law, Electric field intensity, Electric flux density, Gauss's law, Applications of Gauss's law, Potential difference and potential, The dipole, Current and current density, Continuity of current, Conductor properties and boundary conditions, Nature of dielectric materials, Boundary conditions for perfect dielectric materials, Capacitance, Parallel plate capacitor, Poisson's and Laplace's equations.

UNIT - 2 **L-9, T-3**

MAGNETOSTATIC FIELDS: Biot Savart law, Ampere's Circuital law, Magnetic flux and magnetic flux density, Scalar and vector magnetic potentials, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Potential energy and forces on magnetic materials, Self inductance and mutual inductance.

UNIT - 3 **L-9, T-3**

MAXWELL'S EQUATIONS AND WAVE PROPAGATION: Faraday's law, Displacement current, Maxwell's equations in point form, Maxwell's equations in integral form, Wave equations for free space and conducting medium, Uniform plane wave equation, Wave propagation - Free space, conducting medium, Good dielectrics, Good conductors; Skin depth, Wave polarization.

UNIT - 4 **L-9, T-3**

WAVE CHARACTERISTICS: Normal incidence of waves on perfect conductor and dielectric, Oblique incidence of waves on perfect conductor and dielectric, Brewster angle, Surface impedance, Poynting theorem and Poynting vector.

UNIT - 5 **L-9, T-3**

TRANSMISSION LINES: Introduction, Types of transmission lines, Concept of distributed elements, Equations of voltage and current, Phase and attenuation constants, Evaluation of arbitrary constants, Standing waves and impedance transformation, Loss less and low loss transmission lines, Impedance variation on lossless transmission lines, Important characteristics of a lossless line, Power transfer on transmission line, Smith chart.

TEXT BOOKS:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics", 3rd edition, Oxford Press, 2001.
2. William H. Hayt and John A. Buck, "Engineering Electromagnetics", 6th edition, TMH, 2001.

REFERENCE BOOKS:

1. G.S.N. Raju, "Electromagnetic Field Theory and Transmission Lines", Pearson Education, 2005.
2. R.K Shevgaonkar, "Electromagnetic waves", TMH, 2006.
3. S.Salivahanan and S. Karthie, "Electromagnetic Field Theory", 1st edition, Oxford Press, 2016.

ACTIVITIES:

- *Draw the field lines due to point charge, line of charges and sheet of charges.*
- *Draw the field lines to illustrate reflection through a metal plate.*
- *Draw the field lines to illustrate refraction through dielectric.*
- *Identify the useful operating frequency range of the given metallic wire.*
- *Calculate the stub length and position to match the given antenna with 50/ 75 ohm line.*

16EL103 PROFESSIONAL COMMUNICATION LABORATORY

Hours Per Week :

L	T	P	C
-	-	2	1

Course Description and Objectives:

The Professional Communication Laboratory course is aimed at improving professional communication skills (LSRW – Listening, Speaking, Reading and Writing) of undergraduate students and preparing them for their profession as engineers and managers. This course will help students to understand professional communication and personality as two interlinked spheres of influence, and provide them with exposure to conventions of corporate communication involved in the functioning of the business world.

Course Outcomes:

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

CO1: Ability interpret and communicate effectively both in their academic as well as professional environment.

CO2: Identify clear grasp on the register of business language.

CO3: Possess the ability to write clearly and precisely and pass the industry recognized BEC certification.

CO4: Distinguish the differences between formal and informal communication.

SKILLS:

- ✓ *Grammar rules in writing sentences, paragraphs and paraphrasing.*
- ✓ *Compose business emails, memos, letters, reports and proposals.*
- ✓ *Comprehend business articles and documents.*
- ✓ *Use of expressions in professional context and acquire presentation skills like one minute talk and pair discussion.*
- ✓ *Familiarize and comprehend British accent by listening to recorded speeches and discussions.*

UNIT - 1 **Learning-3 Hrs+ Practice -3Hrs =06 Hrs**

BUSINESS ENGLISH VOCABULARY: Glossary of most commonly used words (formal and informal usage) **Elements of Technical Writing**- Sentence structure, reducing verbosity, arranging ideas logically, building coherence, paragraph level and document level, topic sentence, cohesive devices, transitional words, paraphrasing and précis-writing.

Mechanics of Writing- Stylistic elements, the rapporteur, the purpose, the reader's viewpoint (audience), elementary rules of grammar, choice of diction, elementary principles of composition, matters of form, punctuation, conventions of business communication, language and professional tone, weak links in business correspondence, ethical concerns in business writing, code of conduct (not sending illegal, offensive, disparaging personal remarks or comments) in written business communication.

UNIT - 2 **Learning-3 Hrs+ Practice -3Hrs =06 Hrs**

BUSINESS CORRESPONDENCE: E-mail- nature and scope, e-mail etiquette, clear call for action, common errors in composing e-mails, office communication such as meeting agenda and minutes of the meeting, notice, circular and memo.

Letter Writing - Formal and informal letters, structure of formal letters, expressions of salutations, different types of letters [such as sales letter, complaint letter, response to the complaint letter (dispute resolution), letter of permission, letter of enquiring, claim letter, letter of apology etc]; Introductory and concluding paragraphs and clear call for action.

PROFESSIONAL PROPOSAL/REPORT: Differentiating proposals and reports, Drafting formal business proposals, types of reports such as factual reports, feasibility reports and survey reports, parts of a report (such as title page, declaration, acknowledgements, table of contents, abstract, introduction, findings, conclusions, recommendations, citations, references and appendices).

UNIT - 3 **Learning-3 Hrs+ Practice -3Hrs =06 Hrs**

SPEAKING: Speaking in business context, assertiveness, politeness, making requests, queries and questions, negotiations, asking for information, offering suggestions, conflict resolution, contacting clients, initiating, addressing delegates (in public), features of a good power point presentation (making the PPT), delivering the presentation effectively, telephone etiquettes, delivering seminar/proposal/ report effectively, team meeting etiquettes (face to face and conference call), making effective one minute presentations.

UNIT - 4 **Learning-3 Hrs+ Practice -3Hrs =06 Hrs**

READING: Reading and comprehending business documents, learning business register, regularizing the habit of reading business news, suitable vocabulary, skimming and scanning text for effective and speedy reading and dealing with ideas from different sectors of corporate world in different business contexts.

UNIT - 5 **Learning-3 Hrs+ Practice -3Hrs =06 Hrs**

LISTENING: Specific information in business context, listening to telephonic conversations/messages and understanding the correct intended meaning, understanding the questions asked in interviews or in professional settings, summarizing speaker's opinion or suggestion and enable active listening.

TEXT BOOKS: BEC

1. G. B. Hart, "Cambridge English Business Bench Mark: Upper Intermediate', 2nd edition, CUP, 2004.
2. CUP, Cambridge: BEC VANTAGE: Practice Tests, CUP, 2002.

ONLINE REFERENCES:

1. http://www.cambridgeenglish.org/exams/business-certificates/business vantage/ preparation/
2. https://www.youtube.com/watch?v=qxFtn9pGaTI.

ACTIVITIES:

- *Basic grammar practice, framing paragraphs on topics allocated.*
- *Paraphrasing an article or a video in your own words. Finding topic sentences in newspaper articles.*
- *Finding out new words from a professional viewpoint. Understanding the meaning and its usage.*
- *Perusing samples of well prepared proposals and reports.*
- *Draft different proposals/reports on topics assigned.*
- *Watching videos/ listening to audios of business presentations.*
- *Classroom activities of team and individual presentations.*
- *Using PPTs, mock exercises for BEC speaking.*
- *Presenting (speaking) the written components completed in Unit 1.*
- *Hand-outs; matching the statements with texts.*
- *Finding missing appropriate sentence in the text from multiple choice, multiple choices.*
- *Using right vocabulary as per the given context and editing a paragraph.*

16HS301 PROFESSIONAL ETHICS

Hours Per Week :

L	T	P	C
2	-	-	2

Course Description and Objectives:

This course offers insight into workplace rights of people, their safety concerns and more importantly the ethics that are to be followed by professionals and corporates. The objective of the course is to bring in awareness among the students about human values, social responsibility and the ethics to be followed by engineering professionals.

Course Outcomes:

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

CO1: Understand professional responsibilities and ethics in the workplace.

CO2: Have knowledge of contemporary issues related to personal and professional interactions at the workplace.

CO3: Understand the impact of engineering solutions in global and societal context.

SKILLS:

- ✓ *Analyze the issues faced by society and business world related to safe technologies/ practices, employee rights, resource sharing and allocation, team work, organizational dynamics, legislations related to business and technology, discrimination.*
- ✓ *Appreciate the need for workplace etiquette and proper code of conduct.*
- ✓ *Construct and evaluate arguments during decision making by considering viewpoints of all the stakeholders.*
- ✓ *Analyze one's own beliefs and values during interpersonal and intra-organizational conflicts.*
- ✓ *Detect inconsistencies and common errors in reasoning during discussions and practices.*

UNIT - 1 **L-6**

HUMAN VALUES: Morals, Values and ethics, Integrity, Work ethics, Service learning, Civic virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing time, Co-operation, Commitment, Empathy, Self-confidence, Character, Spirituality.

UNIT - 2 **L-6**

ENGINEERING ETHICS & **ENGINEERING AS SOCIAL EXPERIMENTATION:** Engineering ethics - Variety of moral issues, Types of inquiry moral dilemmas, Moral autonomy, Kohlburg's theory, Gilligan's theory impediments to responsible action; Engineering as social experimentation - Codes of ethics, A balanced outlook on law, The challenger case study.

UNIT - 3 **L-6**

ENGINEER'S RESPONSIBILITY FOR SAFETY: Safety and risk, Assessment of safety and risk, Risk benefit analysis and reducing risk, The government regulator's approach to risk, Case studies - The three mile islands, Chernobyl and Bhopal tragedy.

UNIT - 4 **L-6**

WORKPLACE RIGHTS, RESPONSIBILITIES AND WORK ENVIRONMENT: Workplace rights and responsibilities, Engineers and managers, Oganizational complaint procedures, Government agencies, Resolving employee concerns, Limits on acceptable behaviour in large corporation, Work environment, Ethical and legal considerations, Organizational responses to offensive behaviour and harassment, Ethics in a global context.

UNIT - 5 **L-6**

GLOBAL ISSUES: Multinational corporations, Business ethics, Environmental ethics, Computer ethics, Role in technological development, Weapons development, Engineers as managers, Consulting engineers, Engineers as expert witnesses and advisors, Honesty, Moral leadership, Sample code of conduct.

TEXT BOOK:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", 3rd edition, Tata McGraw Hill, 2003.

REFERENCE BOOKS:

1. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, 2004.

2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Learning, United States, 2000.

3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.

ACTIVITIES:

- *Discuss a typical case study on workers strike and analyze the conflict of interest among different stakeholders.*
- *Reading and analyzing a prisoner's narrative of police abuse in custody.*
- *Watch and discuss a video report on mishaps such as space shuttle mishap.*
- *Analyze and comment on disasters such as Chernobyl, Bhopal etc.*
- *Analyze the HR policies documents of a typical company on issues such as working hours, employee security and health care.*

16EC305 COMPUTER ARCHITECTURE AND ORGANIZATION

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

The objective of this course is to analyze architectures and computational designs, understand various conventional computational organizations. This course covers a number of issues involved in the design and utilization of high performance computing systems, including Instruction Set, Architecture, Performance Evaluation, Pipelining, Memory, Multiprocessor and Parallel Computing and Interconnection Network.

Course Outcomes:

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

CO1: Understand the basic structure and operation of a digital computer.

CO2: Apply arithmetic algorithms and interpret the processed data.

CO3: Understand and analyze the concepts of CPU and its operations.

CO4: Categorize various memory mechanisms.

CO5: Understand and comparevarious data transfer techniques.

CO6: Understand the design of a pipelined, array and multiprocessors.

UNIT - 1 **L-9**

INTRODUCTION: Introduction to organization and architecture, Brief history of computers, A Top-level view of computer function and interconnection - Computer components, Computer function, Interconnection structures, Bus interconnection, PCI.

UNIT - 2 **L-9**

CENTRAL PROCESSING UNIT: Computer arithmetic - Integer arithmetic, Floating-Point representation, Floating-Point arithmetic; Instruction sets - Machine instruction characteristics, Types of operands, Types of operations; Instruction sets - Addressing modes, Instruction formats; Processor structure and function - Processor organization, Register organization, Stack organization and Instruction cycle; Control unit operation - Micro-Operations, Control of the processor, Hardwired implementation; Basic concepts of micro programmed control.

UNIT -3 **L-9**

MEMORY: Internal memory - Computer system memory overview, Semiconductor main memory, Cache memory, Virtual memory; External memory - Magnetic disk, RAID, Magnetic tapes, Flash memory.

UNIT - 4 **L-9**

INPUT / OUTPUT: External devices, I/O modules, Programmed I/O, Interrupt driven I/O, DMA, I/O channels and processors.

UNIT - 5 **L-9**

PIPELINE, VECTOR PROCESSING AND MULTIPROCESSORS: Pipeline and vector processing - Parallel processing, Pipelining, Arithmetic pipeline, Instruction pipeline, RISC pipeline vector processing, Array processors; Multiprocessors - Characteristics of multiprocessors, Interconnection structures, Inter processor communication and synchronization, Cache coherence.

TEXT BOOKS:

1. William Stallings, “Computer Organization and Architecture”, 9th edition, Pearson/PHI, 2013.
2. M.Moris Mano, “Computer Systems Architecture”, 3rd edition, Pearson/PHI, 2013.

REFERENCE BOOKS:

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, 5th edition, TMH, 2011.
2. John P.Hayes, “Computer architecture and Organization”, 3rd edition, Tata McGraw-Hill, 1998.
3. P.Pal Chaudhuri, “Computer organization and design”, 3rd edition, Pearson/PHI, 2008.
4. G.Kane and J.Heinrich, “MIPS RISC Architecture”, 2nd edition, Pearson/PHI, Prentice Hall, 1992.

16EC306 VLSI DESIGN

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

The aim of this course is to introduce the basic concepts of digital circuit design using hardware description language and IC fabrication process with CMOS technology and basic electrical properties of MOS transistor. The objective is to introduce CMOS logic gates and their schematics and layouts for designing digital and/or analog circuits.

Course Outcomes:

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

CO1: Analyze the operation and Electrical Behavior of MOS transistors.

CO2: Understand the fabrication process of different MOS technologies.

CO3: Design VLSI circuits and Layouts of simple MOS circuit using Lambda based design rules.

CO4: Develop subsystems (digital circuits) using various logic methods and their limitations. (Minor project)

CO5: Model the combinational and sequential circuits using VHDL.

CO6: Synthesize the digital circuits with hardware description language/schematic levels.(Lab+Minor Project)

SKILLS:

- ✓ *Estimate the layout area and power dissipation of the circuit.*
- ✓ *Customize a model for the particular logic system.*
- ✓ *Identify the design flow of front end and back end.*
- ✓ *Identify the different colour codes for the layouts.*

UNIT - 1 **L-9**

MOS TRANSISTOR INTRODUCTION: Transistor operation, I_{DS}-V_{DS} relationship, Transistor parameters - Threshold Voltage, Transconductance, Output conductance, Figure of merit; Pass transistor, NMOS inverter, Various pull ups, CMOS Inverter, Introduction of Bi-CMOS inverter.

UNIT - 2 **L-9**

MOS FABRICATION: Introduction to IC technology - MOS, PMOS, NMOS and CMOS fabrication processes; Oxidation, Lithography, Diffusion, Ion implantation, Metallization, Encapsulation.

UNIT - 3 **L-9**

MOS Circuit Design: VLSI design flow, MOS layers, Stick diagrams and layout, Design rules for NMOS, CMOS and BICMOS circuits, The delay unit, Inverter delays, Driving capacitive loads, Propagation delays, Wiring capacitances.

UNIT - 4 **L-9**

CMOS SUBSYSTEM DESIGN: Alternate gate circuits, Arithmetic circuits - Adders, Multipliers, Parity generators, Comparators, Zero and one detectors; Design capture tools, Design for testability, Simulation, Synthesis, Introduction to FPGA.

UNIT - 5 **L-9**

INTRODUCTION TO HDL: Hardware description language - VHDL design flow, Program structure, Types and constants, Functions and procedures, Libraries and packages; VHDL design elements - Structural design elements, Data flow design elements, Behavioral design elements.

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

- understand operation and electrical properties of MOS transistors.
- understand fabrication process of MOS technology.
- analyze static characteristics of MOS circuits practically.
- design logic circuits for both NMOS and CMOS.
- understand different modeling styles of VHDL code.
- simulate and verify a VHDL code for different combinational and sequential circuits.

LIST OF EXPERIMENTS Total hours-30

PART-A

Design and simulate the following schematics in NMOS and CMOS Technology in Cadence.

Logic gates like NOT, NAND, NOR, AND, OR, Ex-OR, Ex-NOR, AOI, OAI.

PART-B

Design and simulate the following in Xilinx Software using VHDL.

1.	Logic gates	:	NOT, NAND, NOR, AND, OR, Ex-OR.
2.	Arithmetic Circuits	:	Adders, Subtractors, Multiplier and ALU
3.	Combinational Circuits	:	Decoder, Encoder, Multiplexer, Demultiplexer, Parity Generators and Checkers.
4.	Sequential Circuits	:	Flip-Flops, Counters, Shift Registers.

ACTIVITIES:

- *Simulate a given digital system using HDL.*
- *Synthesize digital system and implement on FPGA kit.*
- *Create schematics to digital system using CMOS.*
- *Evaluate the performance of the given system for available CMOS technologies.*
- *Draw the layout for a given schematic diagram.*

TEXT BOOKS:

1. Kamran Eshraghian, Eshraghian Dougles and A. Pucknell, “Essentials of VLSI circuits and systems”, 1st edition, PHI, 2009.

2. John F. Wakerly, “Digital Design Principles and Practices”, 3rd edition, Prentice Hall, 2010.

REFERENCE BOOKS:

1. S.M. Sze, “VLSI Technology”, 2nd edition, TMH, 2007.

2. N. Weste and K. Eshraghian, “Principles of CMOS VLSI Design”, Pearson Education, 2nd edition, 2010.

3. Bhasker.J, “A VHDL Prime” PHI, 2nd edition, 2008.

16EC307 ANTENNA PROPAGATION

Hours Per Week :

L	T	P	C
3	1	-	4

Course Description and Objectives:

This course offers fundamental knowledge of wave guides and antenna propagataion. The objective of this course is to make the student familiarize with parameters of antenna, different types of antennas and wave propagation.

Course Outcomes:

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

CO1: Analyze the parallel plate waveguide and rectangular waveguides.

CO2: Understand the fundamental characteristics of antennas (gain, bandwidth, directivity etc)in order to compute a wireless communication link.

CO3: Distinguish the characteristics of antenna such as radiation pattern, radiationefficiency, radiation intensity, antenna temperature.

CO4: Analyzedifferent antenna arrays and patterns.

CO5: Design the different antennas and properties.

CO6: Discuss the mechanism of the atmospheric effects on radio wave propagation.

SKILLS:

- ✓ *Demonstrate the TE/ TM modes and identify the advantages of dominant mode.*
- ✓ *Identify the operating range of various standard wave guide sizes, and vice versa.*
- ✓ *Determine the dipole size for the given frequency range.*
- ✓ *Simulate multipath environment and measure the received signal strength.*
- ✓ *Draw the radiation patterns in various planes for uniform linear array (Broad side/endfire).*
- ✓ *Draw the radiation patterns of helical/ horn / aperture antennas.*
- ✓ *Determine the possible link distance for a given antenna height and vice versa.*

ACTIVITIES:

- *Simulate different micro strip antennas for wireless applications like GPS/ Communication/ control.*
- *Simulate base station antennas 2G/ 3G/4G terminals.*
- *Design a Helical antenna / Microstrip antenna FOR Wireless Applications.*
- *Demonstrate multipath environment in urban locations.*

UNIT - 1 **L-9, T-5**

TRANSMISSION LINES AT HIGH FREQUENCIES: Parallel plate waveguides, Rectangular wave guides - Introduction, Application of Maxwell's equations to the rectangular waveguide, TE_{mn} & TM_{mn} modes in rectangular wave guides, Impossibility of TEM waves in wave guides, Attenuation of TE & TM modes, Characteristic impedance of waveguides.

UNIT - 2 **L-9, T-3**

ANTENNA FUNDAMENTALS: Radiation mechanism, Monopole and dipoles, Current distribution on a thin wire antenna, Antenna parameters - Radiation patterns, Patterns in principal planes, Beam widths, Antenna temperature, Radiation intensity, Directivity, Gain, Reciprocity, Input impedance; Radiation resistance of dipole antenna, Relation between effective aperture and directivity, Effective height, Field regions, polarization, FRIIS transmission equation.

UNIT - 3 **L-9, T-4**

ANTENNA ARRAYS: Analysis of uniformly spaced arrays with uniform amplitudes, Principle of multiplication of patterns, Effect of earth on vertical patterns, Patterns in other planes, Binomial array, Basic principle of Dolph- Tschebyscheff array.

UNIT - 4 **L-9, T-2**

CHARACTERISTICS OF TYPICAL ANTENNAS: Rhombic antenna, Folded dipole, Loop antenna, Yagi-Uda array, Helical antenna, Corner reflector, Pyramidal Horn antenna, Parabolic reflector antennas, Slot antennas and micro strip antennas, Concept and benefits of smart antennas.

UNIT - 5 **L-9, T-1**

RADIO WAVE PROPAGATION: Ground wave propagation, Earth constants, Space wave propagation, Fading, Effect of curvature of an ideal earth, Height gain factor, Atmospheric effects in space wave Propagation, Radio-Horizon, Duct propagation, Ionospheric propagation, Gyro frequency, Structure of the Ionosphere, Critical frequency, Skip distance, Maximum usable frequency.

TEXT BOOKS:

1. Constantain A Balanis, "Antenna Theory: Analysis and Design", 4th edition, Wiley Publishers, 2015.
2. Edward C Jordan and Keith G Balmain, "Electromagnetic Waves and Radiating Systems", 2nd edition, PHI, 2003.

REFERENCE BOOKS:

1. J.D.Kraus and Ronald J Marhefka, "Antennas and Wave propagation", 4th edition, TMH, 2014.
2. K.D.Prasad and Satya Prakasan, "Antenna and Wave Propagation", Tech India Publications, 2001.
3. Constantain A Balanis, "Introduction to Smart antennas", 1st edition, Morgan and Claypool Publishers, 2007.
4. G.S.N.Raju, "Antennas and Wave Propagation", 1st edition, Pearson Publication, Singapore, 2005.
5. Samuel Y Liao, "Microwave Devices and Circuits", 3rd edition, Pearson Education, 2003.

16EC308 DIGITAL SIGNAL PROCESSING

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course covers the analysis and representation of discrete-time signal systems and design digital filters.The course objective is to make student understand digital systems and design digital filters including discrete-time convolution, difference equations, the z-transform, and the discrete-time Fourier transform.

Course Outcomes:

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

CO1: Understand the generations and basic concepts of Digital Signal Processor architecture.

CO2: Understand the basics of discrete time signals and systems.

CO3: Apply the concepts of transform techniques in realizing discrete time signals.

CO4: Analyze various transform properties for discrete time signals.

CO5: Design of analog and digital Filters for a given specification.

CO6: Verify various transform techniques and filters.

SKILLS:

- ✓ *Simulate the response of the system from impulse or step stimulus.*
- ✓ *Identify the accelerating methods for processing through DFT & FFT.*
- ✓ *Implement FFT and Inverse FFT.*
- ✓ *Identify the type and order of the filter for the given application.*
- ✓ *Design FIR/ IIR filters for removing unwanted frequencies in the signal.*
- ✓ *Remove the power hum in electronic systems through notch filter implementation.*
- ✓ *Remove the echo in the audio system using DSP processor.*
- ✓ *Analyze the stability of the designed filter.*

ACTIVITIES:

- *Find the response of the given LTI system using impulse input.*
- *Find the response of the given LTI system using step input.*
- *Compute the DFT of a given system.*
- *Compare the 8/ 16 point FFT of the given system with DFT.*
- *Test the stability of given third order filter.*
- *Remove the surrounding motor sound in the MIC signal output.*

UNIT - 1 **L-9**

INTRODUCTION TO DISCRETE TIME SIGNALS AND SYSTEMS AND Z-DOMAIN ANALYSIS: Review of signals and systems, Linear shift invariant systems, Stability and causality, Linear constant coefficient difference equations, Impulse response, Step response, Response to arbitrary inputs, Frequency domain representation of discrete time signals and systems, Z-Transform and properties, Analysis of linear time invariant systems using Z-domain.

UNIT - 2 **L-9**

DFT AND FFT: Discrete fourier representation of periodic sequences (DTFT), Properties, Frequency response, Discrete fourier transform, Properties of DFT, Linear convolution of sequences using DFT, Computation of DFT, Fast fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT algorithms, Inverse FFT, Radix-4 FFT.

UNIT - 3 **L-9**

FIR FILTER DESIGN AND REALIZATION: FIR system function, Characteristics of FIR digital filters, Frequency response, Design of FIR digital filters using window techniques, Frequency sampling technique, Structures of FIR - Direct form structure, Cascade form structure, Linear phase structure, Signal flow graphs and transposed structures.

UNIT - 4 **L-9**

IIR FILTER DESIGN AND REALIZATION: IIR system function, Analog filter approximations, Butter worth and Chebyshev, Design of IIR digital filters from analog filters, Analog-to-Digital transformations, Structures of IIR - Direct form I and II, Cascade form, Parallel form, Signal flow graphs and transposed Structures, Comparison of IIR & FIR filters.

UNIT - 5 **L-9**

DIGITAL SIGNAL PROCESSORS: Introduction, DSP processor memory architecture, Pipelining, Overview of TMS320 family DSP processor, First generation to sixth generation, ADSP processor, Selection of digital signal processors.

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

- write a program on digital signal processing algorithms using MATLAB.
- write programs on a DSP chip for a variety of real-time signal processing applications.
- use the FFT in a variety of applications including: signal analysis, fast convolution, spectral and temporal interpolation and filtering.
- choose and design digital filters.

LIST OF EXPERIMENTS Total hours-30

1. To verify linear convolution and correlation.
2. To find and sketch impulse and step response.
3. To find the FFT of given 1-D signal and plot.
4. To verify circular convolution.
5. FIR filter design using different window techniques.
6. IIR filter design using analog approximations.
7. Spectrum analysis using DFT.

TEXT BOOKS:

1. John G. Proakis and Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms and Applications", 4th edition, Pearson Education/Prentice Hall, 2007.
2. Avtar Singh and S. Srinivasan, "Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx", Cengage Learning India Private limited, 2012.

REFERENCE BOOKS:

1. A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing", 3rd edition, Pearson, 2009.
2. Sanjit K. Mitra, "Digital Signal Processing - A Computer Based Approach", 4th edition, Tata McGraw Hill, 2010.
3. Salivahanan, "Digital Signal Processing", 3rd edition, McGraw Hill, 2015.
4. Emmanuel C. Ifeachor and Barrie.W.Jervis, "Digital Signal Processing", 2nd edition, Pearson Education/Prentice Hall, 2002.
5. Andreas Antoniou, "Digital Signal Processing", 1st edition, Tata McGraw Hill, 2006.

IV

YEAR

ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.

I SEMESTER

- 16MS201 - Management Science
- 16EC401 - Optical Communications
- 16EC402 - Microwave and Radar Engineering
- 16EC403 - Electronic Instrumentation
- 16CS306 - Computer Networks
- \- Department Elective
- \- Department / Open Elective
- \- Employability and Life Skills Elective

II SEMESTER

- 16EC411/412 - Project work / Internship

COURSE CONTENTS

I SEM & II SEM

16MS201 MANAGEMENT SCIENCE

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

This course provides an introduction to the evolution of management along with the framework of managerial functions related to organization structure, production, operations, marketing, human resource management, strategy etc. The objective of the course is to introduce the students and make them well versed with the operational functions of management.

Course Outcomes:

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

CO1: Understand the nature, importance and evolution of management.

CO2: Identify the significance of Operations Management.

CO3: Carry out production operations through work study.

CO4: Understand the markets, customers and competition.

CO5: Plan and control the HR function.

SKILLS :

- ✓ *Analyze and improve productivity.*
- ✓ *Analyze the customer needs, wants and demand.*
- ✓ *Recognize the need of different types/qualities of Human Resources.*
- ✓ *Analyze the reasons for the evolution of management.*
- ✓ *Analyze the philosophies of different management thinkers.*

ACTIVITIES:

- *Solve a test case to identify the various operational functions of management .*
- *Solve a test case to know the importance of marketing.*
- *Solve a test case to know the importance of human resources.*
- *Solve a test case to know the importance and evolution of management discipline.*

UNIT - 1 **L-9**

INTRODUCTION TO MANAGEMENT: Concepts of Management and organization, Nature, Importance and functions of management, Systems approach to management, Taylor's scientific management theory, Fayol's principles of management, Mayo's hawthorne experiments, Maslow's theory of human needs, Douglas McGregor's theory X and theory Y, Herzberg's two factor theory of motivation, Leadership styles, Social responsibilities of management.

UNIT - 2 **L-9**

OPERATIONS MANAGEMENT: Principles and types of plant layout, Methods of production (Job, Batch and mass production), Work study - Basic procedure involved in method study and work measurement

UNIT - 3 **L-9**

MATERIALS MANAGEMENT: Objectives, Need for inventory control, EOQ, ABC analysis, Purchase procedure, Stores management and stores records, Statistical Quality Control - Control charts for variables and attributes (simple Problems), Acceptance sampling.

UNIT - 4 **L-9**

HUMAN RESOURCES MANAGEMENT (HRM): Concepts of HRM, Basic functions of HR manager, Manpower planning, Recruitment, Selection, Training and development, Placement, Wage and salary administration, Promotion, Transfer, Separation, Performance appraisal, Grievance handling and welfare administration, Job evaluation and merit rating.

UNIT - 5 **L-9**

MARKETING MANAGEMENT: Evolution of marketing, Functions of marketing selling Vs marketing, 4 P's of marketing, Product mix, Product life cycle, Place mix - Channels of distribution, Price mix – pricing methods, Promotion mix, Tools of promotions.

TEXT BOOKS:

1. P. Vijay Kumar, N. Appa Rao and Ashnab and Chnalill, "Introduction to Management Science", 6th edition, Cengage Learning India, 2012.
2. Stoner, Freeman and Gilbert, "Management", 6th edition, Pearson Education, 2004.

REFERENCE BOOKS:

1. Kotler Philip and Keller Kevin Lane, "Marketing Mangement", 12th edition, PHI, 2005.
2. Koontz and Weihrich, "Essentials of Management", 6th edition, TMH, 2005.

16EC401 OPTICAL COMMUNICATIONS

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

This course offers fundamental knowledge on optical components such as optical fibers, sources, detectors etc. The objective of this course is to enable the student to understand the basics of optical laws, optical fibre structures, wave guides and signal degradation mechanisium in optical communication system.

Course Outcomes:

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

CO1: Understand the significance of optical communication and fundamental operating principles.

CO2: Estimate the signal distortion phenomena through various parameters like losses and pulse broadening.

CO3: Understand the principles and Analyze efficiencies of various optical sources.

CO4: Investigate the characteristics of different optical connectors.

CO5: Differentiate various optical detectors.

CO6: Understand and estimate link power budget and rise time budget.

SKILLS:

- ✓ *Choose the type and size of fibre and mode of operation for the given application.*
- ✓ *Estimate the loss and the delay in the fibre link.*
- ✓ *Choose the technique for fibre joint.*
- ✓ *Identify the type of source and detector suitable for specific application and estimate its performance.*
- ✓ *Estimate and evaluate the link budget.*

ACTIVITIES:

- *Choose the fiber to transmit 1 Gbps - 10 Gbps data over 500 meters distance.*
- *Find NA and attenuation of a given fibre.*
- *Verify the power output vs I/p Voltage of a given LED/ LASER.*
- *Verify the output current vs I/p power of a given detector.*
- *Choose the receiver front end for the 1 Gbps data link receiver.*

UNIT - 1 **L-9**

OVERVIEW OF OPTICAL FIBER COMMUNICATION: The general system, Advantages of optical fiber communications, Fiber materials, Optical fiber wave guides - Introduction, Ray theory transmission, Total internal reflection, Acceptance angle, Numerical aperture, Skew rays; Cylindrical fibers - Modes, V-number, Mode coupling, Step index fibers, Graded index fibers.

UNIT - 2 **L-9**

SIGNAL DEGRADATION IN OPTICAL FIBERS: Signal distortion in optical fibers- Attenuation, Absorption, Scattering and bending losses, Core and cladding losses, Information capacity determination, Group delay; Types of dispersion - Material dispersion, Wave-guide dispersion, Polarization mode dispersion, Intermodal dispersion; Overall fiber dispersion in multi-mode and Single mode fibers, Pulse broadening.

UNIT - 3 **L-9**

OPTICAL FIBER CONNECTORS: Connector types, Single mode fiber connectors, Connector return loss, Fiber splicing - Splicing techniques, Splicing single mode fibers; Fiber alignment and joint loss - Multimode fiber joints, Single mode fiber joints.

UNIT - 4 **L-9**

OPTICAL SOURCES: LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product, Injection laser diodes- modes, Threshold conditions, External quantum efficiency, Laser diode rate equations.

UNIT - 5 **L-9**

OPTICAL DETECTORS: Physical principles of PIN and APD, Comparison of photo detectors, Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration, Digital receiver performance, Quantum limit, Analog receivers, Optical system design-Considerations, Component choice, Multiplexing, Point to- point links, System considerations, Link power budget, Rise time budget.

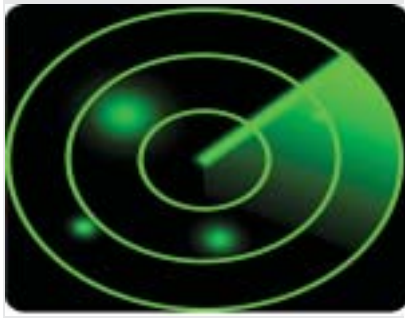
TEXT BOOKS:

1. Gerd Keiser, “Optical Fiber Communications”, 4th edition, McGraw-Hill International, 2015.
2. John M. Senior, “Optical Fiber Communications”, 3rd edition, PHI, 2013.

REFERENCE BOOKS:

1. S.C.Gupta, “Text Book on Optical Fibre Communication and its Applications”, 3rd edition, PHI, 2005.
2. Govind P. Agarwal, “Fiber Optic Communication Systems”, 3rd edition, John Wiley, 2004.
3. Joseph C. Palais, “Fiber Optic Communications”, 4th edition, Pearson Education, 2004.

16EC402 MICROWAVE AND RADAR ENGINEERING



Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course offers concepts of microwave devices, amplifiers, oscillators and radars. The objective of this course is to enable the student to understand microwave components, microwave solid-state devices, microwave tubes, microwave measurement techniques and the basic radar principles and target detection.

Course outcomes:

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

CO1: Understand and apply the concepts of scattering parameters to various microwave components.

CO2: Analyze microwave linear beam tubes.

CO3: Understand and analyze various microwavecross field devices like MAGNETRON, PIN, GUNN, IMPACTT, TRAPATT.

CO4: Perform various microwave measurements.

CO5: Evaluate the performance of different types of Radars.

CO6: Demonstrate the microwave bench setups and microwave components (Lab + Minor project)

SKILLS:

- ✓ *Choose the required component for power coupling in the microwave communication systems.*
- ✓ *Select the high power amplifier/oscillator for the microwave frequency operation.*
- ✓ *Identify the required low power oscillator for receiver applications.*
- ✓ *Measure the impedance value of the given load through VSWR measurement.*
- ✓ *Simulate/Demonstrate the operating principles of CW and Pulse Radars.*

ACTIVITIES:

- *Characterize the given power coupling device.*
- *Find the mechanical tuning range of the given Reflex Klystron.*
- *Find the electronic tuning range of the given GUNN oscillator.*
- *Determine the impedance of the given Horn/ Dielectric/Dish/ Microstrip antenna.*
- *Simulate the RADAR display (PPI/Sector PPI).*
- *Design Police Radar.*

UNIT - 1 **L-9**

MICROWAVE COMPONENTS: Microwave frequencies and band designations, Microwave junctions – E-plane Tee junction, H-plane Tee junction, Magic Tee junction, Applications of magic Tee, Directional couplers; Faraday rotation In ferrite devices - Circulator, Isolator.

UNIT - 2 **L-9**

MICROWAVE LINEAR BEAM TUBES (O TYPE): Limitations of conventional tubes at microwave frequencies, Two cavity klystron amplifiers - Velocity modulation process, Bunching process, Output power and beam loading; Reflex klystron oscillator- Velocity modulation, Power output and efficiency; Operating principles of TWT.

UNIT - 3 **L-9**

MICROWAVE CROSS FIELD TUBES (M TYPE): Magnetron oscillators - Cylindrical magnetron, Cross field amplifiers; Microwave solid-state devices - Detector diode, PIN diode and its applications; Transferred electron devices - GUNN diode, LSA mode of operation, IMPATT and TRAPATT.

UNIT - 4 **L-9**

MICROWAVE MEASUREMENTS: Components of microwave bench set-up, Attenuation measurement, Microwave power measurement, Guide wavelength measurement, VSWR measurement, Impedance measurements.

UNIT - 5 **L-9**

INTRODUCTION TO RADAR ENGINEERING: Radar range equation, Pulse radar, CW radar, FM CW radar, MTI radar.

LABORATORY EXPERIMENTS

COURSE OUTCOMES:

The student will be able to:

- operate microwave equipment such as Klystron bench setup and Gunn bench setup.
- analyze microwave components and devices.
- measure different microwave measurements.

LIST OF EXPERIMENTS Total hours-30

1. Verification of relationship between free space wavelength, guide wavelength and cut-off wavelength.
2. Attenuation measurement.
3. Characterization of magic Tee.
4. Characterization of circulator.
5. Measurement of coupling factor and directivity of directional coupler.
6. Mode characteristics of reflex klystron.
7. Characteristics of Gunn Oscillator.
8. Measurement of Low and High VSWR using Microwave bench.
9. Radiation pattern measurement of rectangular wave-guide.
10. Radiation pattern measurement of twisted wave-guide.

TEXT BOOKS:

1. Samuel Y Liao, "Microwave Devices and Circuits", 3rd edition, Pearson Education, 2003.
2. Merrill I Skolnik, "Introduction to Radar Systems", 3rd edition, McGraw- Hill, 2008.

REFERENCE BOOKS:

1. John Wiley and Robert E. Collin, "Foundations for Microwave Engineering", 2nd edition, John Wiley and sons, 2002.
2. Herbert J. Reich, J.G. Skalnik, P.F. Ordung and H.L. Krauss, "Microwave Principles", CBS Publishers and Distributors, 2004.
3. David M. Pozar, "Microwave Engineering", 4th edition, John Wiley and Sons, 2012.
4. M. Kulkarni, "Micro Wave and Radar Engineering", Umesh Publications, 3rd edition, 1998.
5. Robert E. Collin, "Foundations for Microwave Engineering", 2nd edition, John Wiley and Sons, 2000.
6. Sushrut Das, "Microwave Engineering", 1st edition, Oxford Press, 2014.

16EC403 ELECTRONIC INSTRUMENTATION

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course deals with topics such as principles of measurements, errors, accuracy, units of measurements and standards, Q- meters, watt-meters, semiconductor device testers, counters, digital voltmeters, X-Y recorders, temperature controllers, transducers, introduction to the design of electronic equipments for temperature measurement, resistance, liquid level, speed etc. The objective of the course is to offer knowledge about the measurement systems, measuring instruments, errors, sensors and transducers for various electronic and industrial automation applicaitons.

Course Outcomes:

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

CO1: Understand the fundamentals of static, dynamic characteristics and different errors used in the context of measuring instruments.

CO2: Classifyvarious electro mechanical instruments.

CO3: Measure unknown impedance using AC and DC bridges.

CO4: Understand and analyze various signal generators and Spectrum analyzer.

CO5: Understand theworking principles of Various Display Devices and signal conditioning circuits.

CO6: Demonstrate the characteristics of various sensors.

SKILLS:

- ✓ *Maintain electronic test and measuring instruments.*
- ✓ *Select the instruments for measuring electrical parameters.*
- ✓ *Use AC and DC bridges for relevant parameter measurement.*
- ✓ *Select appropriate passive or active transducers for measurement of a physical phenomenon.*
- ✓ *Use signal generator, frequency counter, CRO and digital IC tester for appropriate measurements.*
- ✓ *Test and troubleshoot electronic circuits using various measuring instruments.*

UNIT - 1 **L-10**

ELECTRO MECHANICAL INSTRUMENTS AND THEIR CHARACTERISTICS: Static characteristics, Dynamic characteristics, Errors - Gross error, systematic error, Random error, limiting error, Probable error; Electro mechanical instruments - Suspension galvanometer, PMMC mechanism, DC Ammeters, DC Volt meters, Ohmmeter, Multi range ohmmeter, Calibration of DC instruments; AC meters - Electro dynamometer, Rectifier meter, Thermo instruments, Watt hour meter, Power measurement using dynamometers, Power factor measurements, Instrument transformers.

UNIT - 2 **L-9**

AC,DC BRIDGES AND ELECTRONIC INSTRUMENTS: DC bridges - Wheat stone bridge, Kelvin's double bridge; AC Bridges - Measurement of inductance, Maxwell's bridge, Anderson bridge; Measurement of capacitance - Schering bridge, Hays bridge; Measurement of frequency - Wien's bridge, Errors and precautions in using bridges; Electronic instruments - Amplified DC meter, True RMS responding voltmeter, Electronic multi-meter, Digital voltmeter, Q-meter.

UNIT - 3 **L-9**

SIGNAL GENERATORS,SIGNAL ANALYSIS AND FREQUENCY COUNTER: Signal generator, Sine wave generator, Sweep generator, Pulse and square wave generator, Frequency synthesized generator, Function generator, Wave analyzers - Harmonic distortion analyzer, FT spectrum analyzer, Applications; Frequency counter and time interval measurement - Simple frequency counter, Time period measurement, Precision computing counter using dual counters.

UNIT - 4 **L-9**

DISPLAY DEVICES ,RECORDERS AND SIGNAL CONDITIONING DEVICES: Display devices - CRO principles, CRO operation and its applications, Dual beam, Dual trace oscilloscope, LCD, LED, Plasma displays; Recorders - Types of recorders, Strip chart recorders, XY recorders, Magnetic tape recorders; Signal conditioning devices - Signal conditioning, Op-Amp, Protection, Filtering.

UNIT - 5 **L-8**

SENSORS AND TRANSDUCERS: Classification of transducers, Stain gauges, Photoelectric transducers, Capacitive, Inductive transducers, LVDT Thermoelectric transducers, Load cell, Light and proximity sensors, Data acquisition systems.

ACTIVITIES:

- *Measure electrical and electronic parameters using various instruments.*
- *Design of data acquisition systems using different sensors and transducers.*
- *Acquire and analyze physical, optical and electrical signals.*
- *Design of electronic equipments, using various instruments and transducers.*

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

- understand operation of different measuring instruments.
- understand the principles of various types of transducers and sensors.

LIST OF EXPERIMENTS Total hours-30

Measurement of

1. displacement using LVDT.
2. distance using LDR.
3. temperature using R.T.D.
4. temperature using thermocouple.
5. pressure using strain guage.
6. pressure using piezo-electric pick up.

7. distance using capacitive pick up.
8. distance using inductive pick up.
9. speed of DC motor using magnetic pick up.
10. speed of DC motor using photo electric pick up.

TEXT BOOKS:

1. A.D. Helfrick and W.D. Cooper, “Modern Electronic Instrumentation and Measurement Techniques”, 5th edition, PHI, 2002.
2. A.K. Sawhany, “Electrical and Electronics Measurements and Instrumentation”, 2nd edition, PHI, 2003.

REFERENCE BOOKS:

1. David A. Bell, “Electronic Instrumentation and Measurements”, 2nd edition, PHI, 2003.
2. R.K. Rajput, “Electronic Measurements and Instrumentation”, 2nd edition, S. Chand, 2009.

16CS306 COMPUTER NETWORKS

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course offers an insight into different LAN and WAN technologies, and various protocols of the layered network architectures that are widely used in network applications. The objective of this course is to enable the student to learn about LAN and WAN technologies, transimission media, reliable communication over a link, packet routing, network congestion, internetworking, Quality of Service (QoS), end to end reliable communication.

Course Outcomes:

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

CO1: Understand the basic concepts of Network hardware, software and reference models.

CO2: Learn different physical layer media and switching methods.

CO3: Identify various protocols involved in data link layer operations.

CO4: Analyzevarious design issues, protocols and functionalities of network layer.

CO5: Apply different protocols to perform end-to-end delivery and interaction with users.

CO6: Implement various protocols with modern tools.

SKILLS:

- ✓ *IImplement Local Area Networks with different topologies.*
- ✓ *Simulate various routing protocols.*
- ✓ *Network trouble shooting.*

ACTIVITIES:

- *Identify various network devices.*
- *Investigate various network topologies.*
- *Connect and Cofigure workstations in Ethernet and WLAN.*
- *Simulate data link protocols.*
- *Detect and correct the errors in data transmission.*
- *Identify different classes of IP addresses.*
- *Analyze IP, TCP, UDP, ARP, DNS, HTTP, FTP, Telnet protocols.*
- *Configre intranet routers.*
- *Develop network applications.*

UNIT - 1 **L-9**

INTRODUCTION: Use of computer networks, Network hardware, Network software, Reference models, Example networks.

UNIT - 2 **L-9**

PHYSICAL LAYER: Guided transmission media,FDM,TDM,Switching.

DATA LINK LAYER: Design issues, Error detection and correction, Elementary data link protocols, Sliding window protocols.

MEDIUM ACCESS CONTROL SUB LAYER: The channel allocation problem, Multiple access protocol,

Ethernet, Wireless LANs, Data link layer switching.

UNIT - 3 **L-9**

NETWORK LAYER: Design issues, Routing algorithms, Congestion control algorithms, Quality of service, Internet working, The network layer in the internet-IPv4, IP addresses, IPv6, ICMP, Mobile IP.

UNIT - 4 **L-9**

TRANSPORT LAYER: The transport service, Elements of transport protocols, The internet transport protocols-UDP and TCP.

UNIT - 5 **L-9**

APPLICATION LAYER: DNS-Domain name system, E-mail, The World Wide Web, Streaming audio and video, Content delivery networks.

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to:

- ✓ understand the structure and organization of computer networks;including the division into network layers, role of each layer, and relationships between the layers.
- ✓ understand the basic concepts of application layer protocol design; including client/server models, peer to peer models, and network naming.
- ✓ in depth understanding of transport layer concepts and protocol design; including connection oriented and connection-less models,techniques to provide reliable data delivery and algorithms for congestion control and flow control.

LIST OF EXPERIMENTS Total Hours-30

1. Implementation of:
    a. Data Link Framing method - Character Count, Bit stuffing and Destuffing.
    b. Error detection method - even and odd parity and CRC Polynomials.
    c. Data Link protocol - Unrestricted simplex protocol.
    d. Data Link protocol - Stop and Wait protocol.
    e. Routing algorithm - Dijkstra's algorithm.

2. Study of Network IP Addressing.
3. Study of TCP/UDP sockets in detail.
4. Design of client server application for file transfer.

TEXT BOOK:

1. Andrew S Tanenbaum, “Computer Networks”, 5th edition, Pearson Education/Prentice Hall, 2011.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, “Data communications and Networking”, 3rd edition, TataMcGraw Hill, 2003.
2. William Stallings, “High Speed Networks and Internets”, 2nd edition, Pearson Education/Prentice Hall, 2002.
3. William Stallings, “Data and Computer Communications”, 7th edition, Pearson Education/Prentice Hall, 2004.
4. S.Kesav, “An Engineering approach to Computer Networking”, 1st edition, Pearson Education/Prentice Hall,1997.

16EC411/16EC412 PROJECT WORK / INTERNSHIP

Hours Per Week :

L	T	P	C
-	-	30	15

Course Outcomes:

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

CO1: Explain the semiconductor devices with the help of V-I characteristics.

CO2: Construct rectifiers with and without filters for ripple factor, clipping circuits to remove noise and clamping circuits to shift level.

CO3: Compare BJT, FET and MOSFET.

CO4: Experiment with BJTs and FETs with biasing techniques for stability factor calculation.

CO5: Demonstrate the characteristics of BJT and FET circuit models.

CO6: Solve transistor amplifier configurations using h-parameters.

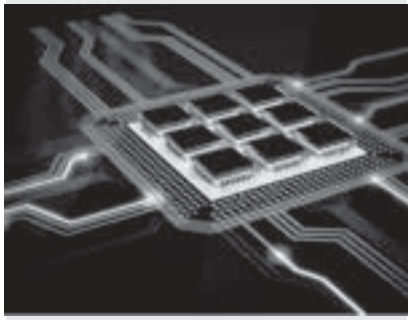
ELECTRONICS AND COMMUNICATION ENGINEERING

B.Tech.

DEPARTMENT ELECTIVE COURSES

- STREAM-1 - VLSI
- STREAM-2 - Communication Systems
- STREAM-3 - Embedded Systems and Networking
- Individual Elective Courses

COURSE CONTENTS



16EC250 DIGITAL SYSTEM DESIGN USING HDL

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course offers knowledge about Hardware Description Language (HDL) used for designing digital systems. The course objective is to introduce the concepts and techniques associated with the HDL, to model the logical expressions of various combinational and sequential circuits.

Course Outcomes:

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

CO1: Apply the concepts of Digital design to create digital building blocks using Verilog.

CO2: Design of combinational and sequential logic circuitsusing Gate level modeling styles of HDL.

CO3: Design Digital Circuits using behavioral modeling.

CO4: Model the CMOS circuits using switch level modeling.

CO5: Understand system tasks, functions, compiler directives in Verilog HDL and FSM.

CO6: Simulate and perform experiments on different digital systems.

SKILLS :

- ✓ *Generate a HDL code for a given specific application.*
- ✓ *Identify the outcome of the system for various inputs.*
- ✓ *Choose the required modeling style for the given application.*

ACTIVITIES:

- *Choose a digital circuit and write a HDL program for any real time application.*
- *Implement any application in FPGA.*

UNIT - 1 **L-9**

INTRODUCTION TO VERILOG: Verilog as HDL, Levels of design description, Concurrency, Simulation and synthesis, Functional verification, System tasks, Programming language interface (PLI), Module, Simulation and synthesis tools, Test benches, Keywords, Identifiers, White space characters, Comments, Numbers, Strings, Logic values, Strengths, Data types, Scalars and vectors, Parameters, Memory, Operators, System tasks, Exercises.

UNIT - 2 **L-9**

GATE LEVEL MODELING: Introduction, AND gate primitive, Module structure, Other gate primitives, Illustrative examples, Tri-state gates, Array of instances of primitives, Additional examples, Design of flipflops with gate primitives, Delays, Strengths and contention resolution, Net types, Design of basic circuits, Exercises.

UNIT - 3 **L-9**

BEHAVIORAL MODELING: Introduction, Operations and assignments, Functional bifurcation, Initial construct, Always construct, Examples, Assignments with delays, Wait construct, Multiple always blocks, Designs at behavioral level, Blocking and non blocking assignments, The case statement, Simulation flow, If and if-else constructs, Assign-deassign construct, Repeat construct, For loop, The disable construct, While loop, Forever loop, Parallel blocks, Force-release construct, Event.

UNIT - 4 **L-9**

DATA FLOW AND SWITCH LEVEL MODELING: Introduction, Continuous assignment structures, Delays and continuous assignments, Assignment to vectors, Operators, Introduction, Basic transistor switches, CMOS switch, Bi-directional gates, Time delays with switch primitives, Instantiations with strengths and delays, Strength contention with trireg nets, Exercises.

UNIT - 5 **L-9**

SYSTEM TASKS, FUNCTIONS AND COMPILER DIRECTIVES: Introduction, Parameters, Path delays, Module parameters, System tasks and functions, File-based tasks and functions, Compiler directives, Hierarchical access, General observations, Exercises, Function, Tasks, User- defined primitives (UDP), FSM design (Moore and Mealy machines).

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to design:

- digital circuits.
- combinational circuits.
- sequential circuits.
- completely and incompletely specified sequential machines.
- different types of memories.

LIST OF EXPERIMENTS Total hours-30

Generate HDL code and simulate the following:

1. Logic gates.

2. Adders.
3. Subtractor.
4. Decoder.
5. Encoder.
6. Multiplexer.
7. DeMultiplexer.
8. Parity circuits.
9. Comparator.
10. Flip Flops.
11. Registers.
12. Shift registers.
13. Counters.
14. FSMs.

TEXT BOOKS:

1. T.R. Padmanabhan and B. Bala Tripura Sundari , “Design through Verilog HDL”, 2nd edition, WSE, 2014 IEEE Press.
2. J. Bhaskar , “A Verilog Primier”, 2nd edition, BSP, 2013.

REFERENCE BOOKS:

1. Stephen. Brown and ZvonkoVranesic, “Fundamentals of Logic Design with Verilog”, 3rd edition, TMH, 2012.
2. Charles H Roth, “Digital Systems Design using VHDL”, Jr. Thomson Publications, 4th edition, 2012.
3. Michael D. Ciletti, “Advanced Digital Design with Verilog HDL”, 3rd edition,PHI, 2013.
4. Charles H Roth Jr, “Digital systems Design using VHDL”, 2nd edition, Thomson Publications, 2010.

16EC271 EMBEDDED SYSTEMS AND RTOS

Hours Per Week :

L	T	P	C
4	-	-	4

Course Description and Objective:

The learner will obtain a good exposure of Embedded Systems and Real Time Operating Systems(RTOS) and will get a knowledge of how to design an embedded system with RTOS.

Course Outcomes:

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

- Understand the fundamentals of embedded systems from both hardware and software perspective.
- Understand the design process of embedded system via descriptive and formalized procedures.
- Explain various embedded system applications and design requirements.
- Generate product specification for embedded system.
- Understand the basic concepts of RTOS.
- Understand the necessity of networked embedded systems for real time applications.
- Understand how to Design embedded system through examples.

SKILLS :

- ✓ *Able to analyze design requirements.*
- ✓ *Able to design new hardware and software for different applications.*
- ✓ *Able to choose RTOS platform for the application*
- ✓ *Able to design Scheduling algorithms for Embedded systems with RTOS*
- ✓ *Able to choose necessary networking for the embedded system*

UNIT - 1 **L-9**

INTRODUCTION TO EMBEDDED SYSTEMS: Basic concepts; Categories, Specialities, Recent trends in embedded systems; Architecture of Embedded Systems: Hardware architecture, Software architecture, Application software, Communication software, Process of generating executable image, Development /testing tools.

UNIT - 2 **L-9**

PROCESS OF EMBEDDED SYSTEM DEVELOPMENT: Requirements, Specification, Architecture design, Designing hardware and software components, System Integration, Formalisms for system design, Structural description, Behavioural description, Program Design and Analysis: Components for Embedded programs, Models of Programs, Assembly, Linking and Loading, Compilation techniques.

UNIT - 3 **L-9**

PROCESSES AND OPERATING SYSTEMS: Multiple tasks and multiple processes, Multirate systems, RTOS basics: Architecture of Kernel, Tasks and Task Scheduler - Task States, Content Switching, Scheduling Algorithms, Rate Monotonic Analysis, Task, Management Function Calls. Interrupt Service Routines, Semaphores, mutex, mailboxes, message queues, event registers, pipes, signals, timers, memory management, Priority Inversion Problem.

UNIT - 4 **L-9**

REAL TIME OPERATING SYSTEMS: POSIX, Windows CE, Networks and Multiprocessors: Categories of Multiprocessors, Distributed embedded systems-Network abstractions, CAN bus, Distributed computing in cars and airplanes, I^2C bus, Ethernet, Internet, MPSoCs and shared memory multiprocessors.

UNIT - 5 **L-9**

DESIGN EXAMPLES: Model train controller, Audio Player, Digital still camera, Engine Control unit, Video accelerator.

TEXT BOOKS:

1. Dr.K.V.K.K.Prasad, Embedded Real time Systems, Dreamtech Press, 2003.
2. Marilynwolf , “Computers as Components: Principles of EmbeddedComputer systems design”, Morgan Kaufmann Publishers, 2000.

REFERENCES :

1. Raj Kamal. Embedded Systems Architecture, Programming and Design. 2nd Edition, McGrawHill, 2012.
2. Arnold S. Berger, An introduction to Processes, Tools and Techniques,CMP books, 2005.
3. Wang K.C., Embedded and Real-Time Operating Systems, Springer, 2017.
4. Frank Vahid and Tony Givargis, Embedded System Design: A Unified Hardware/Software Introduction, John Wiley & Sons, Student edition, 2006.
5. http://esd.cs.ucr.edu/

***ACTIVITY**:*

- *Design an architecture for networked household security system*
- *Design testing procedure for networked household security system*
- *Identify the hardware components necessary for a live traffic control system*
- *Design a I^2C bus basedembedded system for patient monitoring system*
- *Design CAN bus based networked real-time embedded system for automation in automobile industry*

STREAM-1 ELECTIVE

16EC350 PERL AND PYTHON

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

This course offers the students with the concepts of scripting languages like Perl and Python. The objective of this course is to enable the students to design tools for automation and testing using Perl and Python in various engineering domains.

Course Outcomes:

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

CO1: Understand the characteristics, syntax and purpose of scripting languages for various applications.

CO2: Understand programming concepts in Perl.

CO3: Understand programming concepts in Python.

CO4: Develop the code using Perl.

CO5: Develop python scripts.

CO6: Design web applications using Perl and Python.

SKILLS :

- ✓ *Design and develop applications for automation, data processing and testing in various domains like VLSI, Embedded Systems etc.*
- ✓ *Design and development of web applications.*

UNIT - 1 **L-9**

INTRODUCTION TO PERL: Characteristics and uses of scripting languages - Introduction to PERL, Names and values, Variables and assignment, Scalar expressions, Control structures, Built-in functions, Collections of data, Working with arrays, Lists and hashes, Simple input and output.

UNIT - 2 **L-9**

PERL SCRIPTING: Strings - Patterns and regular expressions, Subroutines, Scripts with arguments, Finer points of looping.

UNIT - 3 **L-9**

ADVANCED PERL: Subroutines - Using pack and unpack, Working with files, Navigating the file system, Type globs, Eval, References, Data structures, Packages, Libraries and modules, Objects, Tied variables.

UNIT - 4 **L-9**

PYTHON BASICS: An introduction to Python - Introduction, Brief history of Python, Python versions, Basic python syntax-basic syntax, Comments, String values, String methods, The format method, String operators, Numeric data types, Conversion functions, Simple output, Simple input, The % method, The print function.

UNIT - 5 **L-9**

PYTHON SCRIPTING: Basic operators - Decision, Making, Loops, Numbers, Strings, Lists, Tupple, Dictionary, Date and time, Functions and modules, Files I/O, Regular expressions, Classes and objects.

TEXT BOOKS :

1. David Barron, “The World of Scripting Languages”, student edition, Wiley publications, 2013.
2. Randal L. Schwartz and Tom Phoenix, “Learning PERL”, 3rd edition, Oreilly Publications, 2012.

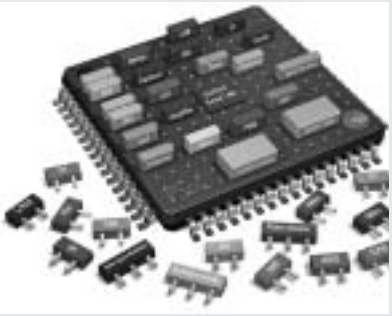
REFERENCE BOOKS :

1. Larry Wall, Tom Christiansen and John Orwant, “Programming PERL”, 3rd edition, Oreilly Publications, 2010.
2. David Beazley and Brian K. Jones, “Python Cookbook”, 4th edition, PHI Publications, 2012.

ACTIVITIES:

- *Implement data types-scalars, arrays, hashes using Perl.*
- *Implement simple matching expressions using Perl.*
- *Develop functions by using Python.*

STREAM-1 ELECTIVE



16EC351 SYSTEM ON CHIP DESIGN

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

This course offers the concepts of integrating all components of any electronic system into a single chip. The objective of the course is to introduce the students to digital, analog, mixed-signal, and radio-frequency functions all on a single chip substrate.

Course Outcomes:

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

CO1: Understand the fundamental concepts, methodologies, design issuesof System-on-Chip.

CO2: Apply the knowledge of methods and design issues in hard core, soft core design process and analog circuits.

CO3: Demonstrate the design methodology for embedded memories and I/Os.

CO4: Analyze the software and hardware simulation and validate it.

CO5: Apply the design methodologies to microprocessor cores.

CO6: Understand and demonstrate testing issues in digital logic cores.

SKILLS :

- ✓ *Draw layout for a given application.*
- ✓ *Identify the outcome of the application for various inputs.*
- ✓ *Choose the required style for the given application.*
- ✓ *Identify the method (FSM/HDE/BDE) to adopt for a given application.*
- ✓ *Write a driver routine to linkup the program with various systems.*

UNIT - 1 **L-9**

INTRODUCTION TO SOC: System tradeoffs and evolution of ASIC technology, System on chip concepts and methodology, SoC design issues, SoC challenges and components.

UNIT - 2 **L-9**

DESIGN METHODOLOGY FOR LOGIC CORES: SoC design flow , On-chip buses, Design process for hard cores, Soft and firm cores, Designing with hard cores, Soft cores, Core and SoC design examples.

UNIT - 3 **L-9**

DESIGN METHODOLOGY FOR MEMORY AND ANALOG CORES: Embedded memories, Simulation modes specification of analog circuits, A to D converters, Phase locked loops, High speed I/O.

UNIT - 4 **L-9**

DESIGN VALIDATION: Core level validation - Test benches, SoC design validation, Hardware / software co-simulation and co-verification; Case study - Validation and testing of SoC.

UNIT - 5 **L-9**

SOC TESTING: SoC test issues - Testing of digital logic cores, Cores with boundary scan, Test methodology for design reuse, Testing of microprocessor cores, Built in self test method, Testing of embedded memories; Case study - Integrating BIST techniques for on-line SoC testing.

TEXT BOOKS:

1. Rochit Rajsuman, "System-on-a-chip: Design and Test", 2nd edition, Santa Clara, CA: Artech House, 2000.
2. Prakash Rashinkar, Peter Paterson and Leena Singh, "System-on-a-chip verification: Methodology and Techniques", 3rd edition, Kluwer Academic Publishers, 2011.

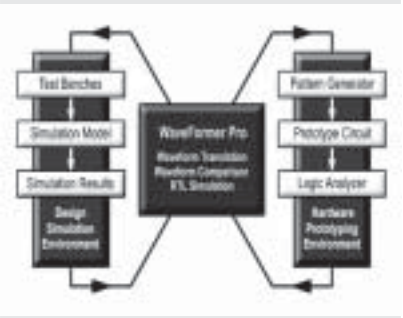
REFERENCE BOOKS:

1. M.Keating, D.Flynn, R.Aitken, A. Gibbons and K. Shi, "Low Power Methodology Manual for System-On-Chip Design Series (Integrated Circuits and Systems)", 2nd edition, Springer, 2007.
2. L.Balado and E. Lupon, "Validation and test of systems on chip", Twelth Annual IEEE conference on ASIC/SOC, 1999.
3. A.Manzone, P.Bernardi, M.Grosso, M.Rebaudengo, E.Sanchez and M.S.Reorda "Integrating BIST techniques for on-line SoC testing", Eleventh IEEE International on line testing symposium, 2005.

ACTIVITIES:

- *Choose a digital circuit and draw layout.*
- *Design and implement a circuit in hardware.*
- *Measure the performance of Combinational circuits like adder, encoder, decoder.*
- *Simulate the performance of Sequential circuits like flip flops, counters etc.*
- *Experiments using Finite state machines like Mealy and Moore machines.*

STREAM-1 ELECTIVE



16EC450 HARDWARE VERIFICATION TECHNIQUES

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

This course provides knowledge about various verification methods for software and hardware, addressing the industry needs in software/hardware co-designs. The objective of the course is to deal with the techniques for verification of hardware and concurrent software programs.

Course Outcomes:

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

CO1: Understand various verification models.

CO2: Apply the test models on the hardware design to verify the functional properties through verification tools.

CO3: Develop testing plan for different levels of verification from specification to features of the hardware design.

CO4: Analyze the responses of different modeling stimulus.

CO5: Design a verification model for hardware architecture using hardware programming language.

CO6: Understand the test vector generation for the given CUT.

SKILLS :

- ✓ *Create test vectors for any given application.*
- ✓ *Identify and rectify the faults in a specified design.*
- ✓ *Detect and rectify hazards in a given application.*
- ✓ *Check the functionality of a given application.*

UNIT - 1 **L-9**

VERIFICATION: Testbench -The importance of verification, Reconvergence model, Automation, Poka-Yoke redundancy, Equivalence checking model, Checking functional verification, Functional verification, Testing versus verification design and verification reuse.

UNIT - 2 **L-9**

VERIFICATION TOOLS: Linting tools - Simulators, Verification intellectual property, Code coverage, Functional coverage verification languages, Assertions, Revision control, Issue tracking metrics, Interpreting metrics.

UNIT - 3 **L-9**

VERIFICATION PLAN: The role of the verification plan, Levels of verification-from specification to features, Directed testbenches approach, Coverage driven, Random based approach directed testcases.

UNIT - 4 **L- 9**

STIMULUS AND RESPONSE: Reference signals, Simple stimulus, Simple output, Complex stimulus, Bus-functional models, Response monitors, Transaction-level interface.

UNIT - 5 **L-9**

ARCHITECTING TEST BENCHES: Test harness, VHDL test harness, Design configuration, Self checking testbenches, Directed stimulus, Random stimulus, Defining scenarios, Behavioral models, Managing simulations, Regression.

TEXT BOOKS:

1. M.Abramovici, M.A.Breuer and A.D. Friedman, “Digital systems and Testable Design”, 3rd edition, Jaico Publishing House, 2009.
2. P.K. Lala, “Fault Tolerant and Fault Testable Hardware Design”, 4th edition, Academic Press, 2012.

REFERENCE BOOKS:

1. P.K. Lala, “Digital Circuit Testing and Testability”, 2nd edition, Academic Press, 2012.
2. M.L.Bushnell and V.D.Agrawal, “Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits”, 2nd edition, Kluwer Academic Publishers, 2012.
3. Janick Bergeron, “Writing Testbenches: Functional Verification of HDL Models”, 2nd edition, Willey publications, 2013.
4. A.L.Crouch, “Design Test for Digital IC’s and Embedded Core Systems”, 4th edition, Prentice Hall International, 2009.

ACTIVITIES:

- *Choose an optimal test set for a digital circuit.*
- *Choose and realize an error free circuit.*
- *Find the test vectors to verify the function of combinational circuits like adder, encoder, decoder etc.*
- *Find the test vectors to verify the function of sequential circuits like flip flops, counters etc.*

16EC451 TESTING OF VLSI CIRCUITS

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

This course imparts knowledge on various types of faults, fault detection techniques and dominance. The objective of this course is to introduce the student to the concepts of test generation for combinational and sequential circuits and other VLSI circuit testing methods like DFT schemes, BIST and BILBO.

Course Outcomes:

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

CO1: Apply the concept of fault models to identify the faults and fault location.

CO2: Analyze the Generation of test patterns for the given combinational, sequential circuits.

CO3: Identify the fault in given CUT (can be logic circuit or memory) and conclude the solution to test these faults.

CO4: Develop the testPatterns with built in self test.

CO5: Verify the fault diagnosis by UUT reduction techniques in combinational circuits and systems.

CO6: Develop self checking designs for fault tolerant systems.

SKILLS :

- ✓ *Create test set for any given application.*
- ✓ *Identify and rectify the faults in a specified design.*
- ✓ *Select the delay model for a given application.*
- ✓ *Determine the suitable DFT and BIST schemes for fault detection.*

UNIT - 1 **L-9**

TESTING AND FAULT MODELLING: Introduction to testing, Faults in digital circuits, Modeling of faults, Logical fault models, Fault detection, Fault location, Fault dominance, Logic simulation, Types of simulation , Delay models, Gate level event, Driven simulation.

UNIT - 2 **L-9**

TEST GENERATION: Test generation for combinational logic circuits, Testable combinational logic circuit design, Test generation for sequential circuits, Design of testable sequential circuits.

UNIT - 3 **L-9**

DESIGN FOR TESTABILITY: Design for testability, Ad-hoc design, Generic scan based design, Classical scan based design, System level DFT approaches.

UNIT - 4 **L-9**

SELF – TEST AND TEST ALGORITHMS: Built-In self test, Test pattern generation for BIST, Circular BIST, BIST architectures, Testable memory design, Test algorithms, Test generation for embedded RAMs.

UNIT - 5 **L-9**

FAULT DIAGNOSIS: Logical level diagnosis, Diagnosis by UUT reduction, Fault diagnosis for combinational circuits, Self-checking design, System level diagnosis.

TEXT BOOKS:

1. M.Abramovici, M.A.Breuer and A.D. Friedman, “Digital systems and Testable Design”, 2nd edition, Jaico Publishing House, 2012.
2. P.K. Lala, “Fault Tolerant and Fault Testable Hardware Design”, 3rd edition, Academic Press, 2012.

REFERENCE BOOKS:

1. P.K. Lala, “Digital Circuit Testing and Testability”, 2nd edition, Academic Press, 2012.
2. M.L.Bushnell and V.D.Agrawal, “Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits”, 2nd edition, Kluwer Academic Publishers, 2012.
3. A.L.Crouch, “Design Test for Digital IC’s and Embedded Core Systems”, 5th edition, Prentice Hall International, 2009.
4. http://nptel.ac.in/courses/106103016/30.

ACTIVITIES:

- *Choose a VLSI circuit and verify*
- *Verify a VLSI circuit and make it error free.*
- *Observe the outputs of Combinational circuits like adder, encoder, and decoder by applying test vectors.*
- *Observe the outputs of Sequential circuits like flip flops, counters etc.*
- *Observe the outputs of Finite state machines like Mealy and Moore machines applying test vectors.*

16EC452 NANO ELECTRONICS

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

This course provides an understanding of nanotechnology in electronic components. It deals with diverse set of devices and materials. The objective of the course is to facilitate the student understand biologically inspired systems, energy effective sensors, robust digital systems and medical electronics.

Course Outcomes:

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

CO1: Understand the history, types and mechanism of Nano Technology.

CO2: Understand the concepts of CNT and CNT FETs.

CO3: Identify the applications of Molecular Electronic devices.

CO4: Analyze the fundamentals of Nano Electronics and Principles of Spintronics and QCA.

CO5: Choose the materials for various silicon MOSFET and quantum transport devices.

CO6: Illustrate the principles of nanoelectronics and their applications.

UNIT - 1 **L-9**

INTRODUCTION TO NANOTECHNOLOGY: Background to nanotechnology, Types of nanotechnology and nanomachines, Periodic table, Atomic structure, Molecules and phases, Energy, Molecular and atomic size, Surface and dimensional space, Top down and bottom up, Molecular nanotechnology, Electron microscope, Scanning electron microscope, Atomic force microscope, Scanning tunnelling microscope, Nanomanipulator, Nanotweezers, Atom manipulation, Nanodots, Self assembly, Dip pen nanolithography.

UNIT - 2 **L-9**

FUNDAMENTALS OF NANOELECTRONICS: Fundamentals of logic devices - Requirements, Dynamic properties, Threshold gates, Physical limits to computations; Concepts of logic devices, Classifications, Two terminal devices, Field effect devices, Coulomb blockade devices, Spintronics, Quantum cellular automata, Quantum computing, DNA computer, Performance of information processing systems, Basic binary operations, Measure of performance processing capability of biological neurons, Performance estimation for the human brain, Ultimate computation, Power dissipation limit dissipation in reversible computation, The ultimate computer.

UNIT - 3 **L-9**

SILICON MOSFETs AND QUANTUM TRANSPORT DEVICES: Silicon MOSFETS - Novel materials and alternate concepts, Fundamentals of MOSFET Devices, Scaling rules , Silicon-dioxide based gate dielectrics, Metal gates, Junctions and contacts, Advanced MOSFET concepts; Quantum transport devices based on resonant tunneling, Electron tunneling, Resonant tunneling diodes, Resonant tunneling devices, Single electron devices for logic applications, Single electron devices, Applications of single electron devices to logic circuits.

UNIT - 4 **L-9**

CARBON NANOTUBES: Carbon Nanotube - Fullerenes, Types of nanotubes, Formation of nanotubes, Assemblies, Purification of carbon nanotubes, Electronic propertics, Synthesis of carbon nanotubes, Carbon nanotube interconnects, Carbon nanotube FETs, Nanotube for memory applications, Prospects of an all carbon nanotube nanoelectronics.

UNIT - 5 **L-9**

MOLECULAR ELECTRONICS: Electrodes and contacts - Functions, Molecular electronic devices, First test systems, Simulation and circuit design, Fabrication, Future applications, MEMS ,Robots, Random access memory, Mass storage devices.

TEXT BOOKS:

1. Michael Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard “Introduction to nanotechnology”, 2nd edition, PHI, 2012.

2. Raguse, “Nanotechnology: Basic Science and Emerging Technologies,” 2nd edition, Chapman and Hall / CRC, 2002.

REFERENCE BOOKS:

1. T. Pradeep, “NANO: The Essentials Understanding Nanoscience and Nanotechnology”, 3rd edition, TMH, 2007.

2. Rainer Waser (Ed.), “Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices”, 2nd edition, Wiley-VCH, 2009.

STREAM-2 ELECTIVE

16EC260 TELEVISION ENGINEERING

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objective :

This course provides the basic concepts of digital TV and video recording system. The objective of the course is to make the students understand /explain the various colour TV systems, standards, Digital TV, HDTV Technologies, video recording system, display system and its applications.

Course Outcomes :

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

CO1: Understand the TV fundamentals of image scanning, frame transmission and retraces.

CO2: Distinguish between television Standards.

CO3: Understand and analyze the digital television Systems.

CO4: Understand and compare digital video compression techniques.

CO5: Gain the knowledge on advanced television technologies.

CO6: Understanddifferent video recording, display and its consumer application.

SKILLS :

- ✓ *Identification of connecting cables for television with set-top box.*
- ✓ *Distinguish between normal digital TV and HD TVs.*
- ✓ *Identification of types of digital TVs and picture quality.*

UNIT - 1 **L-9**

FUNDAMENTALS OF TELEVISION AND DISPLAY: Television basics, Elements of TV system, Low level TV transmission, TV receiver block diagram, Production of luminance and colour difference signal, Composite video signal and channel bandwidth, Color TV systems, Colour fundamentals, Mixing of colors, Color perception, Chromaticity diagram.

UNIT - 2 **L-9**

TV STANDARDS: NTSC, PAL, SECAM systems, Colour TV transmitter, Colour TV receivers, Remote control, Antennas for transmission and TV pattern generation.

UNIT - 3 **L-9**

DIGITAL TV: Introduction to digital TV, Principle of digital TV, Digital TV signals and parameters, Digital TV transmitters, MAC signals, Advanced MAC signal transmission, Digital TV receivers, Basic principles of digital video compression techniques, MPEG1, MPEG2, MPEG4.

UNIT - 4 **L-9**

HDTV: HDTV standards and systems, HDTV transmitter and receiver/encoder, Digital TV satellite systems, CCTV, CATV, Direct to home TV, Set top box with recording facility, 3D TV systems.

UNIT - 5 **L-9**

VIDEO RECORDERS AND CONSUMER APPLICATIONS: IP audio and video, IPTV systems, Mobile TV, Digital video recorders, Colour TV digital cameras, Display devices - LED, LCD, CD/ DVD player, Blue ray DVD player, Dish TV.

TEXT BOOKS:

1. A.M. Dhake, “Television and Video Engineering”, 2nd edition, TMH, 2004.
2. Kelth jack, “Video Demisified”, 5th edition, Elsevier, 2007.
3. R.G. Gupta, “Audio Video Systems”, 2nd edition, 2010.

REFERENCE BOOKS:

1. S. P. Bali, “Color TV Theory and Practice”, TMH, 2007.
2. Gulathi, “Monochrome and Color TV”, New Age International Publications, 2009.

ACTIVITIES:

- *Demonstration of set-top box TV system.*
- *Demonstration of DTH TV system.*

16EC360 CELLULAR AND MOBILE COMMUNICATIONS

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objective:

This course gives an overall understanding of different generations of cellular communication systems, WANs and PANs. The course objective is to give the students mathematical and engineering concepts in the analysis and design of mobile communication systems, an understanding of digital cellular systems (GSM, CDMA), 3G systems, LTE and understanding of PANs like WLAN, Bluetooth Technologies.

Course outcomes:

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

CO1: Understand the concepts of mobile and cellular communications.

CO2: Understand and compare FDMA, TDMA, CDMA and OFDMA methods.

CO3: Analyze various methodologies to improve the cellular capacity.

CO4: Understand and analyze various generations of cellular communications from 1G to 4Gand their architectures. CO5: Understand and analyze the concepts of various wireless networking technologies like Wireless local loop, WiMAX, Mobile IP and WML.

SKILLS :

- ✓ *Determine cell size and number of cells and cell locations for a given topological area.*
- ✓ *Finalize the frequency allocation for various cells with maximum reuse.*
- ✓ *Identify the handoff strategies.*
- ✓ *Estimate system capacity for minimum C/I.*
- ✓ *Suggest methods to improve the signal coverage.*
- ✓ *Choose proper accessing techniques for various generations of cellular communications.*

UNIT - 1 **L-9**

INTRODUCTION TO WIRELESS COMMUNICATIONS AND MULTIPLE ACCESS TECHNIQUES FOR WIRELESS COMMUNICATION: Evolution to mobile radio communications, Mobile radiotelephony in USA and around the world, Examples of wireless communication systems - Paging, Cordless telephone systems and cellular telephone systems; Trends in wireless and personnel communications, Multiple access techniques for wireless communication - Introduction, FDMA, TDMA; Spread Spectrum, Multiple access, SDMA, Packet radio, Packet radio protocols, CSMA protocols, Reservation protocols.

UNIT - 2 **L-9**

THE CELLULAR CONCEPT-SYSTEM DESIGN FUNDAMENTALS: Introduction, Frequency reuse, Channel assignment strategies, Handoff strategies - prioritizing handoffs, Practical handoff considerations, Interference and system capacity, Co-channel Interference and system capacity, Channel planning for wireless systems, Adjacent channel interference, Power control for reducing interference, Trunking and grade of service; Improving coverage and capacity in cellular systems – Cell splitting, Sectoring, Repeaters for range extension, Microcell zone concept.

UNIT - 3 **L-9**

CELLULAR WIRELESS NETWORKS: First generation analogue system - Spectral allocation, Operation, AMPS control channelsl; Second generation (2G) TDMA systems - First and second generation cellular systems, TDMA design consideration, GSM network and its architecture, GSM signalling protocol Architecture; 2G CDMA systems - CDMA, CDMA design consideration, IS-95; 3G systems - CDMA design considerations, 3G WCDMA(UMTS), 3GCDMA 2000, 3G TD-SCDMA; Introduction to LTE.

UNIT - 4 **L-9**

WIRELESS NETWORKING (BTS RADIO LINK): Cordless systems, Wireless local loop, IEEE 802.16 fixed broadband wireless access standard, Mobile IP and wireless application protocol.

UNIT - 5 **L-9**

WIRELESS LANS AND PANS (4G- LONG TERM EVOLUTION): WLAN overview, Infrared LANs, Spread spectrum LANs, Narrowband microwave LANs, Wi-Fi and IEEE 802.11 wireless LAN standard - IEEE 802 protocol architecture, IEEE 802.11 architecture and services, IEEE 802.11 medium access control, IEEE 802.11 physical layer; Bluetooth and IEEE 802.15 - Bluetooth overview, Radio specification, Baseband specification, iLink manager specification, Logical link control and adaptation protocol, IEEE 802.15 standards.

TEXT BOOKS:

1. Theodore. S. Rapport, “Wireless Communications”, 2nd edition, Pearson education, 2002.
2. William Stallings, “Wireless Communications and Networks”, 2nd edition, Pearson education, 2005.

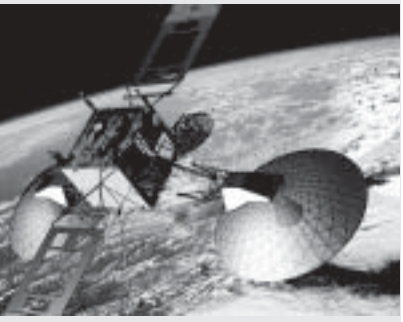
REFERENCE BOOKS :

1. W.C.Y. Lee, “Mobile Cellular Telecommunications”, 3rd edition, McGraw Hill, 2006.
2. R Blake, “Wireless Communication Technology”, 1st edition, Thompson Asia Pvt. Ltd., 2004.
3. Jon W. Mark and Weihua Zhqung, “Wireless Communication and Networking”, 1st edition, PHI, 2005.

ACTIVITIES:

- *Determine number of cells, cell frequencies for Amaravati (Capital City).*
- *Identify the Handoff strategies used by mobile operators in Capital region.*
- *Identification of frequency band of a given Mobile Operator.*
- *Determine the maximum number of users at guest house of VFSTRU and A Block.*
- *Simulate a BTS for GSM.*
- *Determine the data speeds for 2G and 3G at various locations and times.*

STREAM-2 ELECTIVE



16EC460 SATELLITE COMMUNICATIONS

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description & Objective:

This course covers the fundamentals of satellite communications, its sub-systems, signals and noise associated with satellite communications and transmission concepts. The objective is to introduce the mechanisms of satellites and satellite launchers and also to study the design and operation issues of satellite systems.

Course outcomes :

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

CO1: Understand the fundamental concepts of Satellite communication and compare different types of satellite orbits as well as orbital effects in communication systems.

CO2: Perform calculations to determine properties of earth station Antennas, satellite footprints.

CO3: Analyze different satellite sub systems.

CO4: Compute link budget of a satellite system and satellite links for specified system.

CO5: Compare various multiple access techniques in terms of applications.

CO6: Demonstrate the impact of GPS and Navigation design for tracking and Launching.

SKILLS :

- ✓ *Recognize the different bands used in satellites.*
- ✓ *Identify the orbital distances.*
- ✓ *Choose the orbit for the given applications.*
- ✓ *Identify the frequency allocation of TT and C.*
- ✓ *Find the launch vehicles for a given satellite.*
- ✓ *Determine uplink and downlink frequencies and the transmitter and receiver powers required to meet the specified CNR (BER).*
- ✓ *Select multiple access technique.*
- ✓ *Estimate satellite performance and life span.*
- ✓ *Understand different applications of GPS.*

UNIT - 1 **L-9**

INTRODUCTION & ORBITAL MECHANICS AND LAUNCHERS: Origin of satellite communications, Historical back-ground, Basic concepts of satellite communications, Frequency allocations for satellite services, Applications, Orbital mechanics, Look angle determination, Orbital perturbations, Orbit determination, Launches and launch vehicles, Orbital effects in communication systems performance.

UNIT - 2 **L-9**

SATELLITE SUBSYSTEMS: Attitude and orbit control system, Telemetry, Tracking, Command and monitoring, Power systems, Communication subsystems, Satellite antenna equipment reliability and space qualification.

UNIT - 3 **L-9**

SATELLITE LINK DESIGN: Basic transmission theory, System noise temperature and G/T ratio, Design of down links, Up link design, Design of satellite links for specified C/N, System design example.

UNIT - 4 **L-9**

MULTIPLE ACCESS: Frequency division multiple access (FDMA) Intermediation, Calculation of C/N. Time division multiple access (TDMA) frame structure and examples, Satellite switched TDMA onboard processing, Code division multiple access (CDMA), Spread spectrum transmission and reception.

UNIT - 5 **L-9**

LEO AND GEO-STATIONARY SATELLITE SYSTEMS AND GPS: Orbit consideration, Coverage and frequency considerations, Delay and throughput considerations, Radio and satellite navigation, GPS position location principles, GPS receivers and codes, Satellite signal acquisition, GPS navigation message, GPS receiver operation, GPS course acquisition (C/A), Differential GPS.

TEXT BOOKS :

1. Timothy Pratt, Charles Bostian and Jeremy Allnutt, “Satellite Communications”, 2nd edition, Wiley Publications, 2003.
2. Gerard Maral and Michel Bousquet, “Satillite Communication Systems”, 5th edition, Wiley Publications, 2009.

REFERENCE BOOKS:

1. M. Richharia, “Satellite Communications: Design Principles”, 2nd edition, BS Publications, 2003.
2. Dennis Roddy, “Satellite Communications”, 2nd edition, McGraw Hill, 1996.
3. Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud, “Satellite Communications Engineering”, 2nd edition, Pearson Publications, 2003.
4. V.S.Bagad, “Satellite Communications”, 1st edition, Technical Publications, 2009.

ACTIVITY:

- *Determine the global beam, zonal beam and spot beams of a given GEO SAT.*
- *Calculate longitude and latitude of the satellite for a given look angle.*
- *Identify the bands for voice, audio, video and data.*
- *Calculate the BER of the received signal.*
- *Give the coordinates of all the blocks in VFSTR University using GPS.*
- *Convert the given baseband signal with a given spreading code into CDMA.*

STREAM-2 ELECTIVE

16EC461 DIGITAL IMAGE PROCESSING

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objective:

This course offers the analytical tools and methods, which are currently used in digital image processing. The objective of the course is to enable the student to apply the image processing techniques such as restoration, enhancement, compression, segmentation, recognition, representation and classification to different engineering applications.

Course Outcomes:

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

CO1: Understand the fundamental concepts of image processing techniques.

CO2: Analyze images in frequency domain using various transforms.

CO3: Understand and analyze the techniques for image enhancement and restoration.

CO4: Apply segmentation techniques to digital images.

CO5: Categorize and compare various image compression techniques.

CO6: Develop algorithms for different image processing applications.

SKILLS :

- ✓ *Identify and choose appropriate transform for a specific applications.*
- ✓ *Apply spatial and frequency domain filtering techniques.*
- ✓ *Implement algorithms for enhancement, restoration, compression etc.*

UNIT - 1 **L-12**

DIGITAL IMAGE FUNDAMENTALS: Elements of visual perception, Image sensing and acquisition, Image sampling and quantization, Basic relationship between pixels, Basic geometric transformations, Introduction to fourier transform and DFT, Properties of 2D ourier transform, FFT and separable image transforms, Walsh, Hadamard, Discrete Cosine transform, Haar transform, Slant transform, Hotelling transform and singular value decomposition.

UNIT - 2 **L-9**

ENHANCEMENT: Spatial domain methods**,** Basic grey level transformation, Histogram equalization, Image subtraction, Image averaging, Spatial filtering - Smoothing, Sharpening; Laplacian filters, Frequency domain filters - Smoothing, Sharpening filters; Homomorphic filtering.

UNIT - 3 **L-7**

RESTORATION: Model of image degradation/restoration process, Noise models, Inverse filtering, Least mean square filtering, Constrained least square filtering, Blind image restoration, Pseudo inverse filtering.

UNIT - 4 **L-8**

SEGMENTATION: Detection of discontinuities - Point, Line and edge detection using prewitt, Sobel and canny operators; Hough transform, Thresholding - Global thresholding, Optimum global thresholding using Otsu's method; Multiple thresholding, Region based segmentation.

Unit - 5 **L-9**

COMPRESSION: Fundamentals of image compression, Image compression models, Lossless compression - Variable length coding, Bit plane coding, Predictive coding, DPCM; Lossy Compression, Transform coding, Wavelet coding, Basics of image compression standards - JPEG, MPEG; Basics of vector quantization.

LABORATORY EXPERIMENTS

Course outcomes:

The student will be able to:

- apply various arithmetic operations on an image.
- plot and observe the Fourier transform of an image.
- plot and observe the histogram for various types of images.
- implement various filtering techniques on an image.
- implement the segmentation of an image.

LIST OF EXPERIMENTS Total hours-30

1. Image reading and arithmetic operations on image.
2. To verify convolution and correlation of images.
3. To find and plot the spectrum of image using DFT.
4. To find and sketch the histogram for image and histogram processing.
5. Enhancement of the images by using spatial filters
6. Enhancement of the images by using frequency domain filters

ACTIVITY:

- *Image acquisition by using various resolution cameras and comparision of visual quality variation.*
- *Implement image processing algorithms like enhancement, Restoration, segmentation and compression.*

7. Image restoration using various spatial masks.
8. Image restoration using various filtering methods
9. Detection of points , lines and edges using various methods
10. Image segmentation using otsu's method
11. Compression of images: JPEG and JPEG2000.

TEXT BOOKS:

1. Rafael C Gonzalez and Richard E Woods , "Digital Image Processing", 3rd edition, Pearson Education, 2015.
2. A.K. Jain, "Fundamentals of Digital Image Processing", 3rd edition, PHI, 1988.

REFERENCE BOOKS:

1. Millman Sonka, Vaclav hlavac and Roger Boyle, "Image Processing Analysis and Machine Vision", 3rd edition, Thompson Learning, 2007.
2. Chanda Dutta Majumdar, "Digital Image Processing and Applications", 1st edition, Prentice Hall of India, 2000.
3. Rafael C Gonzalez, Richard E Woods and Steven L Eddins, "Digital Image Processing using MATLAB", 2nd edition, Pearson Education, 2004.

16EC270 EMBEDDED LINUX

Hours Per Week :

L	T	P	C
3	1	-	4

Course Description and Objectives :

This course offers fundamental concepts of Linux programming, compiling, libraries and other basic tools for testing and debugging. The objective of this course to provide the studnet with the concepts of kernel programming and developing embedded applications with Linux.

Course Outcomes :

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

CO1: Understand the fundamentals of GNU/Linux architecture.

CO2: Understand the GNU compiler tool chain.

CO3: Investigatedifferent GNU tools for build, test and profile.

CO4: Analyze various Linux kernels in terms of process scheduling, resource sharing, inter process communication and etc.

CO5: Develop applications for GNU/Linux.

CO6: Test and debug the applications using GNU/Linux tools.

SKILLS :

- ✓ *Operate Linux with command line interface.*
- ✓ *Identify tools required to build a kernel.*
- ✓ *Identify tools required for testing and application development.*
- ✓ *Recognize how a process is scheduled.*
- ✓ *Identify Inter process communication in Linux.*
- ✓ *Test the application with GNU tools.*

ACTIVITIES:

- *Choose a kernel for a smartphone/ laptop and embedded applications.*
- *Test the code coverage of given application program.*
- *Build a kernel with given target board specifications.*
- *Build a library for arithmetic operations.*
- *Demonstrate interprocess communication with IPC mechanisms.*

UNIT - 1 **L-9,T-3**

INTRODUCTION: GNU/Linux History, GNU/Linux architecture, Free software development.

GNU TOOLS-I: The GNU compiler Tool chain.

UNIT - 2 **L-9,T-3**

GNU TOOLS-II: Building software with GNU make, Building and using libraries, Coverage testing with GNU gcov, Profiling with GNU gprof.

UNIT - 3 **L-9,T-3**

LINUX KERNEL: Introduction to the linux kernel, Getting started with the kernel, Process management, Process scheduling.

UNIT - 4 **L-9,T-3**

APPLICATION DEVELOPMENT: File handling in GNU/Linux, Programming with pipes, Introduction to sockets programming, GNU/Linux process model, POSIX threads (Pthreads) programming, IPC with message queues, Synchronization with semaphores, Shared memory programming, Other application development topics.

UNIT - 5 **L-9,T-3**

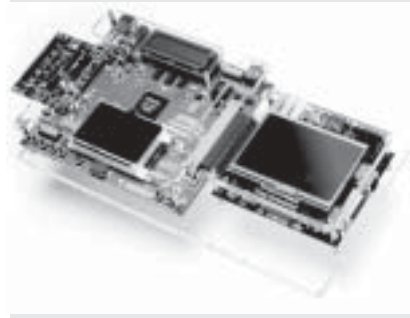
GNU/LINUX SHELLS AND SCRIPTING: GNU/Linux commands, Bourne-Again shell (bash), Debugging and testing, Software unit testing frameworks, Debugging with GDB.

TEXT BOOKS :

1. M. TIM Jones, “GNU/LINUX Application Programming”, 2nd edition, Charles River Media, 2008.
2. Robert Love and Addison-Wesely, “Linux Kernel Development”, 3rd edition, Addison-Wesly, 2010.

REFERENCE BOOKS :

1. W. Richard Stevens, “Unix Network Programming”, 2nd edition, Pearson Eduction, 1999.
2. Alessandro Rubini and Jonathan Corbet, “Linux Device Drivers”, 2nd edition, O Reilly and Associates, Inc, 2001.



16EC370 MICROCONTROLLERS FOR EMBEDDED SYSTEMS

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives :

The learner will obtain a good exposure of Embedded Systems covering the hardwarecomponents and software aspects and will get a good knowledge of ARM processors and LPC2148 chip and their programming and interfacing.

Course Outcomes :

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

CO 1: Identify the software and hardware components used for embedded system.

CO 2: Select the microcontrollers for a given application on the requirements.

CO 3: Understand the basics of 8051 microcontroller and ARM-7 processor.

CO 4: Analyze the architectural features and on-chip system components of LPC2148 controller.

CO 5: Describe the architecture and instruction set of ARM Cortex M3 microcontroller.

CO 6: Develop programs for embedded systems using C and Embedded C.

SKILLS :

- ✓ *Able to analyze design requirements.*
- ✓ *Able to design new hardware and software for different applications.*
- ✓ *Able to design systems using LPC 2148 and ARM Cortex-M3.*
- ✓ *Able to develop programs using Embedded-C for LPC 2148.*

ACTIVITIES:

- *Interface LEDs to ARM7 controller.*
- *Interface a stepper motor to ARM 7 controller.*
- *Interface a DAC-ARM LPC2148.*
- *Interface a ADC-LPC 2148.*
- *Interface a seven segment display.*

UNIT - 1 **L-9**

INTRODUCTION TO EMBEDDED SYSTEMS: Basic concepts; Categories, Specialities, Recent trends in embedded systems; Architecture of Embedded Systems: Hardware architecture, Software architecture, Application software, Communication software, Process of generating executable image, Development /testing tools, Process of Embedded System Development: The development process, Requirements engineering, Design

UNIT - 2 **L-9**

TYPES, SELECTION AND APPLICATIONS OF MICROCONTROLLERS: Microcontrollers, Types of Microcontrollers, Examples of Popular Microcontrollers, Selection of Microcontroller, Applications, Overview of 8051 microcontroller, ARM processor fundamentals.

UNIT - 3 **L-9**

LPC 2148 CONTROLLER ARCHITECTURE: General Description – Features – Block diagram – Overall pin description (functional) - Architectural Overview On-chip Flash program memory –Onchip SRAM –Memory Map - Interrupt Controller – General Purpose I/O (GPIO) – ADC and DAC –UARTs - USB Controller - Timers and Counters – Watchdog Timer – Real-time CLK.

UNIT - 4 **L-9**

ARM CORTEX-M3: ARM Cortex-M3 Processor –Architecture- Instruction Set Development, TheThumb-2 Technology.

UNIT - 5 **L-9**

OVERVIEW OF C: Programming in C, Arrays, Structures, Pointers, Loops and Decisions, Functions, EMBEDDED C: Header files forProject and Port, Example:Restructuring the Hello, Embedded World example. LPC 2148 PROGRAMMING: Programming of LPC 2148 GPIO ports - Generation of PWM signals -Simple programs.

TEXT BOOK :

1. Dr.K.V.K.K.Prasad, Embedded Real time Systems, Dreamtech Press, 2003.
2. Raj Kamal. Embedded Systems Architecture, Programming and Design. 2nd Edition, McGrawHill, 2012.
3. Michael J Pont, “Embedded C”, Pearson Education, 2007.
4. The indefinite guide to ARM CORTEX-M3.

REFERENCE BOOKS :

1. Arnold S. Berger, An introduction to Processes, Tools and Techniques,CMP books, 2005
2. Wang K.C., Embedded and Real-Time Operating Systems, Springer, 2017.
3. Frank Vahid and Tony Givargis, Embedded System Design: A Unified Hardware/Software Introduction, John Wiley & Sons, Student edition, 2006.
4. Marilyn wolf , “Computers as Components: Principles of Embedded Computer systems design”, Morgan Kaufmann Publishers,2000.
5. ARM system developers guide, Andrew N Sloss, Dominic Symes and Chris Wright,Elsevier,Morgan Kaufman publishers, 2008.
6. ARM System on Chip Architecture – Steve Furber – 2nd ed., 2000,Addison Wesley Professional.

ONLINE MATERIALS :

1. www.nxp.com/documents/data sheets/LPC2148.pdf
2. www.microbuilder.en/LPC2148.aspx
3. NPTEL-http://nptel.ac.in/courses/108102045.
4. http://esd.cs.ucr.edu.

16EC371 ADHOC AND SENSOR NETWORKS

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives :

This course offers details basic principles of Ad-hoc and Sensor Networks (ASNs). The objective of this course is to provide the student with the knowledge of wireless sensor networks, MANETs, MAC protocols, routing protocols and energy conservation of ASNs.

Course Outcomes :

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

CO1: Understand the basic concepts of wireless networks connected in infrastructure and Ad-hoc modes.

CO2: Understand and analyze the MAC and Routing challenges of mobile Ad-hoc networks.

CO3: Understand the architecture of the sensor node and a WSN.

CO4: Investigate the MAC protocols for sensor networks.

CO5: Investigate thevarious routing protocols for sensor networks.

CO6: Develop power efficient methods for Ad-hoc and sensor networks.

SKILLS :

- ✓ *Implementation of MAC and routing protocols for sensor networks.*
- ✓ *Design and implementation of wireless sensor networks for various applications.*
- ✓ *Analyze the energy issues in ASNs.*

ACTIVITIES:

- *Implement routing protocols (simulation).*
- *Demonstrate sensor motes.*

UNIT - 1 **L-9**

INTRODUCTION TO WIRELESS NETWORKS: Evolution, GSM, GPRS, PCS, Introduction to packet radio networks, Technical challenges, PRNET, Routing in PRNET, Route calculation, Pacing techniques.

UNIT - 2 **L-9**

AD HOC WIRELESS NETWORKS: Introduction to Ad-hoc network, Heterogeneity in Mobile devices, Wireless sensor networks, Applications, Basic sensor mote, Advantages, Traffic profiles, Types of Ad-hoc mobile communications, Challenges facing Ad-hoc mobile networks.

UNIT - 3 **L-9**

AD HOC WIRELESS MEDIA ACCESS PROTOCOLS: Introduction, Problems in Ad-hoc channel access, Receiver initiated MAC protocols, Sender initiated MAC protocols, MACA, MACA-BI, PAMAS.

UNIT - 4 **L-9**

AD HOC WIRELESS ROUTING PROTOCOLS: Classification of protocols, Protocols, DSDV, AODV,DSR, TORA, LAR, ZRP.

UNIT - 5 **L-9**

ENERGY CONSERVATION POWER LIFE ISSUES: Power management, Advances in device power management, Advances in protocol power management, Beaconing types, Comparison of HF beaconing with and without neighbors, LF beconing, Ad-hoc nomadic mobile applications.

TEXT BOOK:

1. C.K Toh, “Ad hoc Mobile Wireless Networks”, 1st edition, Pearson, 2007.

REFERENCE BOOKS:

1. Carlos, Morais, Cordeiro, “Adhoc and Sensor Networks Theory and Applications”, 2nd edition, World Scientific, 2011.
2. Manuals and Technical Documents from the ARM Inc,web site.

16EC470 HIGH SPEED NETWORKS

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives :

This course offers the fundamentals of high speed networks and their applications. The objective of this course is to provide the student with knowledge of high speed data communication networks, concepts of quality of service and design of high speed networks.

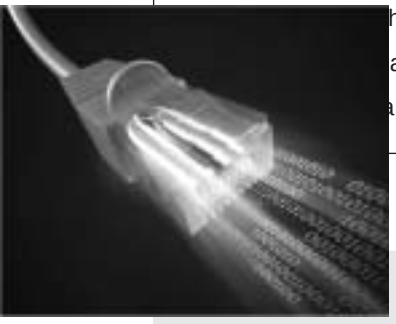
Course Outcomes :

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

CO1: Understand the basic concepts of frame relay and ATM.

CO2: Understand and analyze the applications, requirements and architectures of WLAN.

CO3: Analyze various Queue management and traffic management methods.



he techniques required to support real-time traffic and congestion control.

analyze various integrated and differentiated services.

nd compare various QoS support protocols.

- ✓ *Demonstrate the knowledge of network planning and optimization.*
- ✓ *Design and configure networks to support a specified set of applications.*

ACTIVITIES:

- *Determine the throughput and speed of Vignan's GBNKN.*
- *Determine the quality of internet broadband interms of latency and jitter for IP based applicaitons.*

UNIT - 1 **L-9**

HIGH SPEED NETWORKS: Frame relay networks, Asynchronous transfer mode, ATM protocol architecture, ATM logical connection, ATM cell, ATM service categories, AAL, High speed LANs - Fast ethernet, Gigabit ethernet, Fiber channel; Wireless LANs - Applications, Requirements, Architecture of 802.11.

UNIT - 2 **L-9**

CONGESTION AND TRAFFIC MANAGEMENT: Queuing analysis, Queuing models, Single server queues, Effects of congestion, Congestion control, Traffic management, Congestion control in packet switching networks, Frame relay congestion control.

UNIT - 3 **L-9**

TCP AND ATM CONGESTION CONTROL: TCP flow control, TCP congestion control, Retransmission, Timer management, Exponential RTO backoff, KARN's algorithm, Window management, Performance of TCP over ATM, Traffic and congestion control in ATM, Requirements, Attributes, Traffic management frame work, Traffic control, ABR traffic management, ABR rate control, RM cell formats, ABR capacity allocations, GFR traffic management.

UNIT - 4 **L-9**

INTEGRATED AND DIFFERENTIATED SERVICES: Integrated services architecture, Approach, Components, Services, Queuing discipline, FQ, PS, BRFQ, GPS, WFQ, Random early detection, Differentiated services.

UNIT - 5 **L-9**

PROTOCOLS FOR QOS SUPPORT: RSVP, Goals and characteristics, Data flow, RSVP operations, Protocol mechanisms, Multiprotocol label switching, Operations, Label stacking, Protocol details, RTP, Protocol architecture, Data transfer protocol, RTCP.

TEXT BOOK :

1. William Stallings, "High Speed Networks and Internet", 2nd edition, Pearson Education, 2002.
2. Abhijit S. Pandya and Ercan Sea, "ATM Technology for Broad Band Telecommunication Networks", 1st edition, CRC Press, 2004.

REFERENCE BOOKS :

1. Warland and Pravin Varaiya, "High performance communication networks", 2nd edition, Jean Harcourt Asia Pvt. Ltd., 2001.
2. Irvan Pepelnjk, Jim Guichard and Jeff Apcar, "MPLS and VPN architecture", Volumes 1 and 2, Cisco Press, 2003.

16CS307 OPERATING SYSTEMS

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objectives:

This course focusses on how the operating system effectively manages the system resources. The objective of this course is to provide classical internal algorithms and structures of operating systems, including CPU scheduling, memory management, and file management concepts.

Course Outcomes:

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

CO1: Understand the basics of operating system principles.

CO2: Apply the knowledge of different classes and structure of operating system and requirement of system protection.

CO3: Analyze the scheduling, page replacement policies for the process execution.

CO4: Understandand analyze memory management and device management.

CO5: Identify the needsof operating systems in the field of communication and computer networks.

CO6: Analyze various inter process communication methods.

SKILLS:

- ✓ *Install / remove an operating system in a computer.*
- ✓ *Manage open source operating systems like ubuntu, fedora etc.*
- ✓ *processes scheduling and execution.*
- ✓ *Memory management.*

ACTIVITIES:

- *Identify and install various operating systems.*
- *Simulate and compare process scheduling.*
- *Simulate deadlock prevention and avoidance.*
- *Identify page replacement strategies.*
- *Identify different disk scheduling methodologies.*

UNIT - 1 **L-9**

INTRODUCTION: What operating system do, Operating system structure, Process concept, Overview, Process scheduling, Operations on process, Inter process communication, Process scheduling, Scheduling criteria, Scheduling algorithms, Multiple-Processor scheduling, Case Study - Process scheduling in linux.

UNIT - 2 **L-9**

PROCESS SYNCHRONIZATION: The critical-section problem, Peterson's solution, Synchronization hardware, Semaphores, Monitors, Classical problems of synchronization.

UNIT - 3 **L-9**

DEADLOCKS: Deadlock characterization, Methods of handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery

UNIT - 4 **L-9**

MEMORY MANAGEMENT: Continuous memory allocation, Paging, Structure of the page table, Segmentation, Demand paging, Page replacement algorithms.

SECONDARY-STORAGE STRUCTURE: Overview of mass-storage structure, Disk structure, Disk scheduling.

UNIT - 5 **L-9**

FILE SYSTEMS: File concept, Access methods, Directory structure, File system mounting, File sharing, Protection, File-System structure, File system implementation, Directory implementation, Allocation methods, Free space management.

LABORATOTY EXPERIMENTS

Course Outcomes:

The student will be able to :

1. understand the structure and organization of operating systems including functionalities.
2. understand the basic concepts of process scheduling, deadlock, page replacement.
3. develop understanding of memory management and file system concepts.

LIST OF EXPERIMENTS Total hours-30

1. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close.
2. Write programs using the I/O System calls of UNIX operating system. (open, read, write, etc)
3. Write C programs to simulate UNIX commands like ls, grep, cp.
4. Obtain the list of processes, their CPU burst times and arrival times through the keyboard. Display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
5. Obtain the list of processes, their CPU burst times and arrival times through the keyboard. Display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.

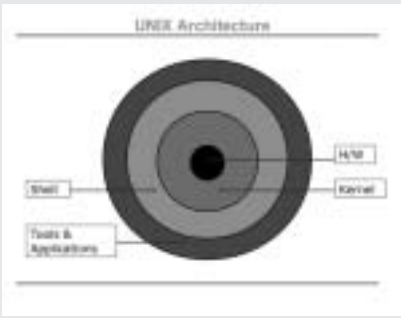
6. Develop Application using Inter-Process-Communication (Using shared memory, pipes or message queues).
7. Implement the Producer-Consumer problem using semaphores (Using UNIX system calls).
8. Implementation of Banker's Algorithm to Deadlock Avoidance.
9. Implement some Memory management schemes like Paging and Segmentation.
10. Implement some Memory management schemes like First Fit, Best Fit & Worst Fit.
11. Implement any file allocation techniques (Contiguous, Linked or Indexed).

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th edition, John Wiley and Sons Inc, 2013.

REFERENCE BOOKS:

1. Richard. Stevens and Stephen A Rago, "Advanced Programming in the Unix Environment", Addison-Wesley, 3rd edition, 2013
2. William Stallings, "Operating Systems – Operating System: Internals and Design Principles", 6th edition, Prentice Hall, 2005.
3. Andrew S Tanenbaum, "Modern Operating Systems", 3rd edition, Prentice Hall, 2007.



16EC380 UNIX AND SHELL PROGRAMMING

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

This course offers UNIX OS and Shell programming used for all client server programs and Internet. The main objective of the course is to enable the students to understand and use the commands according to user requirements, to write shell scripts to perform the given task and write programs in UNIX.

Course Outcomes:

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

CO1: Understand the basic concepts of UNIX architecture.

CO2: Understand UNIX basic commands, file system, process and network utilities.

CO3: Apply various shell commands for UNIX utilities.

CO4: Apply various functions for file and directory management.

CO5: Investigatedifferent commands to control UNIX process.

CO6: Develop applications using various inter process communication methods.

SKILLS:

- ✓ Create, edit, compile, compare, and merge files/directories using UNIX basic commands.
- ✓ Demonstrate the use of Vi editor in UNIX environment.
- ✓ Design and implement automation of tasks, data and string processing and file manipulations using UNIX shell scripting.
- ✓ Design and implement client/server program using concepts UNIX process.
- ✓ Design and implement IPC mechanism using FIFO and message queues.
- ✓ Design and implement semaphores for overcoming race condition.

UNIT - 1 **L-9**

INTRODUCTION TO UNIX: Introduction to UNIX, Unix structure, Unix features, Common commands - Date, Time, Calender, Who, Password, Echo and man; Basic Vi editor - Modes, Commands related to modes, Inserting, Deleting text and moving cursor; File systems, File names, File types, Directories, File permissions, Commands are covered here are - cp, mv, ln, rm, unlink, mkdir, rmdir, du, df, mount, umount, find, umask, ulimit, ps, who, finger, arp, ftp, telnet and rlogin; process utilities, Disk and network utilities.

UNIT - 2 **L-9**

UNIX UTILITIES: What is a shell, Shell relationships, Standard streams, Redirection, Pipes, Tee command, Command substitution, Shell variables, Conditions, History and control structures and shell programming, Filters, Text processing utilities and backup utilities, Detailed commands to be covered are - cat, tail, head, sort, nl, uniq, grep, egrep, fgrep, cut, paste, join, tee, more, pg, comm, cmp,diff, tr, awk and tar.

UNIT - 3 **L-9**

FILE I/O AND FILE DIRECTORIES: File descriptor, Open function, Close function, Create function, Lseek, read, write, Filesharing, Dup and dup2 functions, fcntl, Ioctl functions, File status, Stat, fstat, lstat functions, File types, Permission, Ownership of new files and directories, File system, Links, File times, Directory related functions, System calls to be covered are - access,umask, chmod, fchmod, chown, link, unlink, symlink, mkdir, rmdir, chdir, fchdir, getcwd and utime.

UNIT - 4 **L-9**

ENVIRONMENT OF UNIX PROCESS & PROCESS CONTROL: Process identifiers, fork, vfork, exit, wait, waitpid, wait3, exec functions, Race conditions, Zombie process, Signal concepts, Signal handling, Important signals - kill, raise, alarm, pause, and abort.

UNIT - 5 **L-9**

INTER PROCESS COMMUNICATION: Pipes, FIFO, System V IPC - Message queue, Semaphore and shared memory.

ACTIVITIES:

- *Design and implementation of a database system for students with Register no, Name, Semester, Subjects, Mid-1 Marks, Mid-2 Marks, Mid-3 Marks, etc., using UNIX Shell Scripts.*
- *Design and implementation Client/Server programs using "C" Programs, to access the data base of department, for giving access to different users.*
- *Design of tools using UNIX shell scripts for processing data of department database to display the average mid marks of each student, no of subjects failed etc.*

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS Total hours-30

1) llustrate the sequence of instructions for the following activities:
    a. Write a small text file “myfile.txt”
    b. Save the program on to the disk
    c. Copy the file to “myfile_2.txt”
    d. Rename the file “myfile_1.txt”
    e. List the files in the directory
    f. Remove the file “myfile_1.txt”
2) Write a small “C” program using Vi editor and execute for
    a. Finding sum of squares of ‘n’ numbers
    b. Conversion of from foreign heat to centigrade, inches to centimeters, miles to kilometers.
3) Write a shell program to find the area of
    a. Circle
    b. Triangle
    c. Square
4) Write shell scripts for
    a. copying multiple files in to a directory
    b. to find no. of words and characters in a given file
    c. Factorial of a given number
5) Write shell script to
    a. perform simple calculator
    b. print “Fibonacci series”
    c. print multiplication table for a given number
6) Write a shell program to display the grade of the students according to the following

    “The marks obtained by a student in 6 different subjects are input through keyboard. The student gets a division as per the following rules and it has to be displayed:

    a) Percentage greater than or equal to 70 – I Division with Distinction
    b) Percentage between 60 and 69.99 – I Division
    c) Percentage between 50 and 59.99 – II Division
    d) Percentage below 50 – Fail
7) Write a “C” program to
    a. print the permissions of a given file for 3 types of users
    b. determine and print the type of file using stat
    c. display the access, modification and status change time of a file
8) Write a “C” program to illustrate creation of process using fork.
9) Write a “C” program to provide IPC using pipes.
10) Write a “C” program that implements producer consumer problem using semaphore system calls.

11) Write a “C” program to create a message queue and send a message into the queue, read the message in the message queue.

12) Write a “C” program that illustrates the inter process communication using shared memory.

TEXTBOOKS:

1. Behrouz A. Forouzan and Richard F.Gilberg, “Unix and shell Programming”, 1st edition,Thomson, 2005.

2. W.R.Stevens, “Advanced Programming in the UNIX environment”, 1st edition, Pearson Education, 2006.

REFERENCE BOOKS:

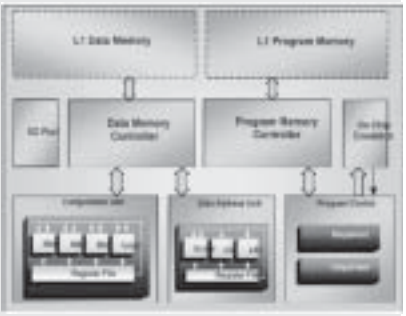
1. Uresh vahalia, “Unix internals,the new frontiers”, 1st edition, Printice Hall Publications, 1995.

2. Meeta Gandhi, “The C Odyssey UNIX “, 3rd edition, BPB Publications, 2004.

3. Yashwant Kanitkar, “Unix Shell programming”, 1st edition, BPB publications,1996

4. Sumithabha Das, “Unix The Ultimate Guide”, 1st edition, Tata McGraw Hill, 2008.

INDIVIDUAL ELECTIVE



16EC480 DSP ARCHITECTURES AND PROGRAMMING

Hours Per Week :

L	T	P	C
3	-	2	4

Course Description and Objective:

This course provides basic knowledge on digital signal processors. The objective of this course is to introduce the student to third generation DSP Architecture and programming skills, advanced DSP architectures and some applications.

Course Outcomes:

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

CO1: Understand the fundamentals of programmable DSP architectures.

CO2: Investigate the details of TMS320C5x and TMS320C6x.

CO3: Develop basic ALP/C program using TMS320CXX Processor for various applications.

CO4: Analyze ADSP based processor and understand its applications.

CO5: Understand about various advanced DSP Processors.

CO6: Verify various transform techniques and filters using DSP processor.

SKILLS :

- ✓ *Differentiate the architectural differences for general and DSP processors.*
- ✓ *Differentiate fixed point and floating point architectures.*
- ✓ *Implement assembly code in 320C5X and 320C6X processors .*

UNIT - 1 **L-9**

FUNDAMENTALS OF PROGRAMMABLE DSPs: Multiplier and multiplier accumulator, Modified bus structures and memory access in PDSPs, Multiple access memory, Multi-port memory, VLIW architecture, Pipelining, Special addressing modes in P-DSPs, On chip peripherals.

UNIT - 2 **L-9**

TMS320C5X PROCESSOR: Architecture, Assembly language syntax, Addressing modes, Assembly language instructions, Pipeline structure, Operation, Block diagram of DSP starter kit, Application programs for processing real time signals.

UNIT - 3 **L-9**

TMS320C6X PROCESSOR: Architecture of the C6x processor, Instruction set, DSP development system, Introduction to DSP starter kit support tools, Code composer studio, Support files, Programming examples to test the DSK tools, Application programs for processing real time signals.

UNIT - 4 **L-9**

ADSP PROCESSORS: Architecture of ADSP-21XX and ADSP-210XX series of DSP processors, Addressing modes and assembly language instructions, Application programs, Filter design, FFT calculation.

UNIT - 5 **L-9**

ADVANCED PROCESSORS: Architecture of TMS320C54X, Pipe line operation, Code composer studio, Architecture of TMS320C6X, Architecture of Motorola DSP563XX, Comparison of the features of DSP family processors.

ACTIVITIES:

- *Implement adaptive LMS filter.*
- *Realize adaptive RLS filter.*
- *Implement Kalman filter.*

LABORATORY EXPERIMENTS

Course Outcomes:

The student will be able to implement on DSP processors:

- linear and circular convolutions.
- FIR and IIR filters.
- DFT.

LIST OF EXPERIMENTS - (Implementation on DSP Processors DSK6713)

Implementation of :

1. linear convolution
2. circular convolution
3. FIR filters
4. IIR filters
5. DFT
6. FFT

TEXT BOOKS:

1. B.Venkataramani and M.Bhaskar, “Digital Signal Processors – Architecture, Programming and Applications”, 1st edition, TMH, 2002.

2. Avtar Singh and S. Srinivasan, “Digital Signal Processing – Implementations using DSP Microprocessors with Examples from TMS320C54xx”, 1st edition, Cengage Learning, 2012.

REFERENCE BOOKS:

1. Rulph Chassaing, “Digital Signal Processing and Applications with the C6713 and C6416 DSK”, 1st edition,Wiley and Sons, 2005.

2. User guides Texas Instrumentation, Analog Devices, Motorola.

16EC481 ROBOTICS AND AUTOMATION

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives :

This course offers basic knowledge on robotics and automation that are essential for various engineering disciplines. The objective of the course is to enable the student to learn design, build, program and control robotic devices by applying science, technology, engineering and mathematical concepts.

Course Outcomes :

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

CO1: Illustrate theory of robot statics and dynamics

CO2: Understand the principles of machine vision and develop a mission vision system.

CO3: Compare different mechanical configurations available for an industrial robot for various tasks.

CO4: Understand the source of error in robots

CO5: Develop online and offline programs for a robot to perform specified tasks.

CO6: Select appropriate sensors for a given automation application

UNIT - 1 **L-9**

INTRODUCTION TO AUTOMATION AND ROBOTICS: Fiction and history from leonardo da vinci onwards, Classification of robots, Fixed and flexible automation, High speed automation, Social and economic aspects, Safety issues and risk assessment, Future applications.

UNIT - 2 **L-9**

MACHINE DESIGN: Degrees of freedom, Actuators and power transmission, End effector design, robot accuracy.

UNIT - 3 **L-9**

MACHINE CONTROL: Feedback control, Servomechanisms, PLC's and fieldbus, Kinematic analysis.

UNIT - 4 **L-9**

SENSORS AND MACHINE VISION: Transducers,Tactile and proximity sensors, Vision-Image analysis, Cameras, Optics, Lighting and applications.

UNIT - 5 **L-9**

ROBOT PROGRAMMING AND LANGUAGES: Methods of programming, Teach mode, Off line and graphical simulation, Languages, e.g. RAPID.

TEXT BOOKS:

1. Saeed B. Niku, "Introduction to Robotics: Anaylysis, Systems and Applications", 2nd edition, John Wiley and Sons, 2011.
2. John J. Craig, "Introduction to Robotics: Mechanics and Control", 3rd edition, Pearson Education International, 2005.

REFERENCE BOOK:

1. S. R. Deb and S.Deb, "Robotics Technology and Flexible Automation", 2nd edition, TMH, 2010.

16CS457 INTERNET OF THINGS

Hours Per Week :

L	T	P	C
3	1	-	4

Course Description and Objective :

This course offers skills on interconnection and integration of the physical world and the cyber space. The objective of the course is to enable the students to design and develop IoT systems.

Course outcomes :

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

CO1: Classify efficient architectures of IoT.

CO2: Design an IoT system for a specific scenario.

CO3: Familiarize with the architecture of M2M.

ifferent protocols for system management.

ogical design and development of IoT using Python packages.

ious devices, interfaces and boards to program IoT physical devices.

- ✓ *use various sensors and actuators for IoT applications.*
- ✓ *interface programming on I/O devices.*
- ✓ *develop applications for the Internet of things.*

ACTIVITIES:

- *Build applications using IoT.*

UNIT - 1 **L-9,T-3**

INTRODUCTION & CONCEPTS: Introduction to Internet of Things, Physical Design of IOT,Logical Design of IOT, IOT Enabling Technologies, IOT Levels

UNIT - 2 **L- 9,T-3**

INTERNET PRINCIPLES: INTERNET COMMUNICATIONS: An Overview, IP Addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style.

UNIT - 3 **L- 9,T-3**

M2M: M2M, Difference between IOT and M2M, SDN and NFV for IOT **IEEE 802.15.4:** Physical layer, MAC layer, Uses and future of 802.15.4 **Zigbee:** Architecture, Association, Network layer, APS layer and security. **Z-Wave:** Z-waveProtocal

UNIT - 4 **L-9,T-3**

SENSORS AND ACTUATORS: Micro sensors: Introduction, Thermal Sensors, Radiation Sensors, Mechanical Sensors, Magnetic Sensors, Bio(chemical) Sensors,

UNIT - 5 **L- 9,T-3**

CASE STUDY & ADVANCED IOT APPLICATIONS: IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments.
Case study illustrating IoT design: Home Automation, Cities, Environment, Agriculture, Productivity Applications

TEXT BOOKS:

1. Vijay Madisetti, ArshdeepBahga," Internet of Things A Hands-On- Approach",2014,
2. Adrian McEwen, "Designing the Internet of Things", Wiley Publishers, 2013,
3. Steve Heath, "Embedded Systems Design", 2nd Edition, Newnes.
4. Oliver Hersent, David Boswarthick, Omar Elloumy, "The Internet of Things: Key Applications and Protocals",1st Edition , 2015.
5. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr.OvidiuVermesan, Dr. Peter Friess, River Publishers
6. Julian W. Gardner,Vijay K. Varadan, Osama O. Awadelkarim, "Microsensors, MEMS and Smart Devices"

REFERENCE BOOKS:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013.
2. CunoPfister, Getting Started with the Internet of Things, O Reilly Media, 2011, ISBN: 978-1-4493- 9357

16EC482 MEMS AND NEMS

Hours Per Week :

L	T	P	C
3	-	-	3

Course Description and Objectives:

This course offers fundamental concepts of MEMS and NEMS methodologies for logic and analog cores. The objective of the course is to enable the student to understand the basic concepts of MEMS and NEMS and their validation.

Course Outcomes:

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

CO1: Understand the effects of miniaturization on device performance and applications of MEMS.

CO2: Identify the process technology required for fabrication of MEMS and NEMS devices.

CO3: Analyze various micro sensors.

CO4: Apply the miniaturisation principles to design of actuators.

CO5: Understand quantum mechanics that is applicable at nano scale for NEMS devices.

CO6: Identify the applications of NEMS devices.

UNIT - 1 **L-9**

OVERVIEW AND INTRODUCTION: New trends in engineering and science, Micro and nanoscale systems introduction to design of MEMS and NEMS, Overview of nano and microelectromechanical systems, Applications of micro and nanoelectromechanical systems, Microelectromechanical systems, Devices and structures definitions, Materials for MEMS, Silicon, Silicon compounds, Polymers, Metals

UNIT - 2

L-9

MEMS FABRICATION TECHNOLOGIES: Microsystem fabrication processes, Photolithography, Ion implantation, Diffusion, Oxidation, Thin film depositions, LPCVD, Sputtering, Evaporation, Electroplating, Etching techniques, Dry and wet etching, Electrochemical etching, Micromachining, Bulk micromachining, Surface micromachining, High aspect-ratio (LIGA and LIGA-like) technology, Packaging - Microsystems packaging, Essential packaging technologies, Selection of packaging materials.

UNIT - 3 **L-9**

MICRO SENSORS: MEMS sensors, Design of acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and piezo resistive pressure sensors, Engineering mechanics behind these Microsensors, Case study, Piezo-resistive pressure sensor.

UNIT - 4 **L-9**

MICRO ACTUATORS: Design of actuators - Actuation using thermal forces, Actuation using shape memory alloys, Actuation using piezoelectric crystals, Actuation using electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical motors and pumps; Case study - Comb drive actuators.

UNIT - 5 **L-9**

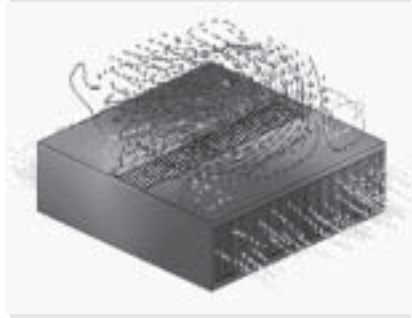
NANOSYSTEMS AND QUANTUM MECHANICS: Atomic structures and quantum mechanics, Molecular and nanostructure dynamics, Shrodinger equation and wavefunction theory, Density functional theory, Nanostructures and molecular dynamics, Electromagnetic fields and their quantization, Molecular wires and molecular circuits.

TEXT BOOKS:

1. Tai Ran Hsu, “MEMS and Microsystems Design and Manufacture”, 1st edition, Tata McGraw Hill, 2002.
2. Chang Liu, “Foundations of MEMS”, 2nd edition, Pearson education India limited, 2006,

REFERENCE BOOKS:

1. Sergey Edward Lyshevski, “MEMS and NEMS: Systems, Devices and Structures”, CRC Press, 2002.
2. Marc Madou, “Fundamentals of Microfabrication”, CRC press, 1997.



16EC490 THERMAL MANAGEMENT OF ELECTRONIC SYSTEMS

Hours Per Week :

L	T	P	C
2	-	-	2

Course Description and Objectives:

This course provides electronics engineers and students with an understanding of the principles and practice of thermal management. The objective of the course is to introduce the student to thermal management in electronic systems which is increasingly becoming a very critical design requirement. In addition to design requirements, heat transfer techniques are explained in the course. These techniques are demonstrated with many practical examples from industry applications.

Course Outcomes:

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

- understand the importance of thermal management in electronic systems.
- have familiarity on terminologies of thermal design.
- understand fundamentals of heat transfer.
- estimate and measure thermal profiles.
- understand thermal design guidelines for PCBs.
- optimise heat sinks for passive and active cooling.

UNIT - 1 **L-10**

INTRODUCTION TO THERMAL MANAGEMENT AND SOURCES OF HEAT IN ELECTRONICS: Introduction, Power trends and environmental loads, Principles of heat transfer conduction, Convection and radiation, Electro-thermal analogues, Interface thermal resistance, Active power devices, Power resistors, Computing devices, High frequency transformers, PCB track resistance, LEDs, Estimation and budgetting of power losses.

UNIT - 2 **L-10**

THERMAL DESIGN TECHNIQUES: Operating environment for components and sub-assemblies, PCB layout and placement of dissipative components, Enclosure design, Heat sinks and estimation of thermal resistance, Selection and use, Identifying and correcting hot spots, Insulating and interface materials, Forced ventilation – Fans, Heat pumps, Indoor and outdoor considerations.

UNIT - 3 **L-10**

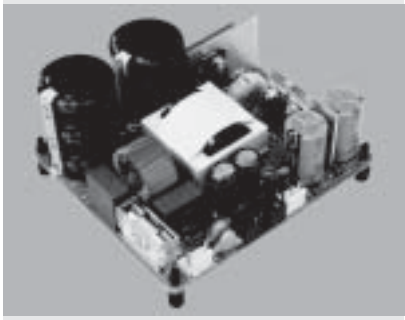
PRACTICAL CONSIDERATIONS AND THERMAL MANAGEMENT TRENDS: Case studies - Laptop, SMPS power module, Base station control panel, Prototype validation - Power, Temperature measurement, Airflow and pressure measurement, Climatic endurance testing, Reliability and temperature, Drivers and challenges, Key technologies and tools, Thermal modelling, Advanced techniques.

TEXT BOOKS:

1. Younes Shabany, “Heat Transfer: Thermal Management of Electronics”, 1st edition, CRC Press, 2009.
2. Ralph Remsburg, “Thermal Design of Electronic Equipment”, 1st edition, CRC Press, 2001.

REFERENCE BOOK:

1. Glenn R. Blackwell Ed., “The Electronic Packaging Handbook”, 1st edition, CRC Press, 2001.
2. http://www.electronics-cooling.com/



16EC491 INTRODUCTION TO SWITCH MODE POWER CONVERTERS

Hours Per Week :

L	T	P	C
2	-	-	2

Course Description and Objectives:

This course offers introduction to power electronic and switch mode power converters. The objective of the course is to introduce the students to basic principles and configuration of converters and regulators. It also provides introduction to magnetic components and semi conductor switching elements.

Course Outcomes:

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

- have a good insight into power conversion methodologies.
- understand magnetic components, switching devices and control schemes.
- design power converters for a given application.
- build and test power converters.
- understand the packaging and EMI issues in switch mode converters.

UNIT - 1 **L-12**

INTRODUCTION TO POWER CONVERTERS AND SWITCH MODE CONVERTERS: Power supplies and schemes, Linear and switching converters, Feedback control, Applications and industry needs, Basic principles and various configurations of converters, Design equations and waveforms of Buck regulators, Boost regulators, Forward converts, Fly back converters, Full bridge converters.

UNIT - 2 **L-11**

MAGNETIC COMPONENTS AND SEMICONDUCTOR SWITCHING ELEMENTS: Concepts of magnetic components, Design of inductors, Design of transformers, Losses in transformers, Temperature rise, Introduction to switching devices, Fast recovery diodes, Drive considerations, Protecting the devices, Thermal considerations, Understanding data sheets.

UNIT - 3 **L-7**

CONTROL SCHEMES: Basic control systems, Stability and compensation, Response times, Methods of control, Practical aspects of control mechanism, Galvanic isolation.

TEXT BOOKS :

1. Abraham I. Pressman, Keith Billings and Taylor Morey, “Switching Power Supply Design”, 3rd edition, MGH, 2009.
2. Erickson, Robert W, Maksimovic and Dragan, “Fundamentals of Power Electronics”, 2nd edition, Springer Science, 2001.