Structure &syllabus
of
Third year

(w.e.f.:-2017-18)

SEMESTER V

Sr No	Course Type	Course Name	Teaching Scheme L	T	P	Credits
1	BSC	Random Signals & Stochastic Processes	3	0	0	3
2	MLC	Constitution of India	1	0	0	0
3	ILOE in Humanities/ HSMC	Institute will offer courses (select any one) • English Language Proficiency-I • Finance for Engineers -I • Engineering economics-I • Industrial Psychology-I • Personal Psychology-I • Japanese Language-I • German Language-I	2	0	0	2
4	SBC	Skill based course: Electronic measurements and standards	1	0	2	2
5	PCC1	Digital Signal Processing	3	1	0	4
6	PCC2	Digital Communication Systems	3	0	0	3
7	PCC3	Computer Architecture	3	0	0	3
8	PCC4	Electromagnetic Waves	3	0	0	3
9	LC1	Digital Signal Processing lab	0	0	2	1
10	LC2	Digital Communication Systems lab	0	0	2	1
11	LC3	Computer Architecture lab	0	0	2	1
			19	1	8	
		Total Academic Engagement and Credits				23

Random Signals & Stochastic Processes

Teaching Scheme
Lectures: 3 hrs/week

Examination scheme
100 marks: Continuous evaluation-
Assignments / Quiz- 40 Marks
End-Sem Exam - 60

Unit 1: Probability **(6hrs)**

Introduction to probability, sets, fields, events, Axiomatic definition of probability, Joint, Conditional and Total Probabilities, Bayes theorem and applications.

Unit 2: Random Variables I **(7hrs)**

Introduction and Definition of a Random Variables, Probability / Cumulative Distribution Function, Probability Density Functions, Conditional and joint distributions and densities, Functions of Random Variables.

Unit 3: Random Variables II **(7hrs)**

Expectation and introduction to estimation: Conditional Expectations, Moments, Chebyshev and Schwarz Inequalities, Characteristic Functions.

Unit 4: Random Processes **(8hrs)**

Basic Definitions and Important Random Processes, Useful classifications of Random Processes.

Unit 5: Random Sequences **(8hrs)**

Random Sequences and Linear systems, Wide Sense Stationary Random Sequences, Markov Random Sequences (ARMA Models, Markov Chains), Convergence of Random Sequences.

Unit 6: Applications **(4hrs)**

Applications to statistical Signal Processing, Introduction of Adaptive Digital Filtering

Text Books

- Henry Stark, John W. Woods, "Probability and Random Processes with Applications to Signal Processing", Third Edition, Pearson Education.
- Veerarajan ,Probability, Statistics and Random Processes", Tata Mc. Graw-Hill
- Schaum's outline Of Theory and Problems of Probability, Random Variables, and Random Processes.

Reference Book

- Athanasios Papoulis, S. Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", Fourth Edition, Tata Mc. Graw-Hill.

Course Outcomes:

After successfully completing the course students will be able to:

1. Develope applications of statistics in information systems.
2. Develop basic applications for performance analysis using probabilistic framework: Estimation,Detection,whitening, MGF ,Various Types of random variables, random processes and properties.
3. Use probabilistic analysis and study its ramifications to communication and signal processing.

CONSTITUTION OF INDIA

Teaching Scheme
Lectures : 2 hrs/week

Examination Scheme
40 marks: Continuous evaluation- Assignments/Quiz
End-Sem Exam- 60 Marks

Unit 1 **(03 hrs)**
Meaning and history of Constitution.
Understanding the concept of Human Rights and Fundamental Rights.

Unit 2 **(06 hrs)**
Introduction to The Constitution of India, understanding its objects. Preamble to the constitution of India.
Fundamental rights under Part – III, exercise of rights, limitations and important cases. Prerogative Writs.

Unit 3 **(04 hrs)**
Relevance of Directive principles of State Policy under Part – IV, Fundamental duties & their significance.

Unit 4 **(03 hrs)**
Union Executive – President, Prime Minister, Parliament & the Supreme Court of India.

Unit 5 **(03 hrs)**
State executive – Governors, Chief Minister, State Legislature and High Courts

Unit 6 **(04 hrs)**
Constitutional Provisions for Scheduled Castes & Tribes, Women & Children & Backward classes.
Emergency Provisions.

Unit 7 **(03 hrs)**
Electoral process.
Amendment procedure, 42^{nd} , 44^{th} , 73^{rd},74^{th} , 76^{th} , 86^{th} , 91^{st} , 98^{th} and latest amendment.
Constitutional amendments.

Text Books

- Introduction to the Constitution of India by Durga Das Basu (Students Edn.) Prentice – Hall EEE, 19th/20th Edn., 2001.
- Engineering Ethics by Charles E.Haries, Michael. S.Pritchard and Michael J.Robins Thompson Asia, 2003-08-05.

Reference Books

- An Introduction to Constitution of India by M.V. Pylee, Vikas Publishing.

Course Outcomes

1. Student will be able to understand how India has come up with a Constitution which is the combination of the positive aspects of other Constitutions.
2. Student will be able to understand the interpretation of the Preamble.
3. Student will be able to understand the basics of governance of our nation.
4. It helps in understanding the different aspects covered under the different important Articles.
5. Student will be able to understand the basic law and its interpretation. Understand the important amendments which took place and their effects.
6. Student will be able to understand our Union and State Executive better.
7. Student will be able to understand the basic that along with enjoying the rights one needs to fulfill one's duties.
8. Student will be able to understand and Gain confidence on our Constitution by knowing it better.

Skill based course

Electronic Measurements and Standards

Teaching Scheme
Lectures: 1 hr/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments / Quiz- 40 Marks
End-Sem Exam - 60

Basics of Electronic Measurement: **(3hrs)**

Terminology of measurements such as accuracy, precision, sensitivity, resolution, Errors, Importance of calibration, instrument calibration standards

Oscilloscopes: **(3hrs)**
Digital Storage Oscilloscope, Digital Phosphor Oscilloscope, Mixed Signal Oscilloscope.

Signal Generator: **(2hrs)**
Waveform generator, Arbitrary Generator.

Signal Analyzer: **(4hrs)**
Spectrum Analyzer, Harmonic Analyzer.

Virtual Instruments: **(2hrs)**
LabVIEW , Case study on applications of the electronic Instruments.

Reference Book:

- Albert D. Helfrick, William D. Cooper, "Modern Electronic Instrumentation & Measurement

  Techniques. Prentice Hall of India. Fifth print & onwards.
- David A. Bell, "Electronic Instrumentation & Measurements", PHI. 2ndEdition Onwards.
- Different Websites on Electronic Measurements.

Course Outcomes:

After successfully completing the course students will be able to:

1. Specify and use electronic instrumentation and measurement systems.
2. Develop fundamental analytical ability towards precise measurements .
3. Apply and carry out direct digital measurements of Signals and its spectrum .
4. Use the concept of virtual instrumentation & GUI .

List of Experiments for LAB (Any 8)

1. Measuring Different parameters of the Signal using DSO.

2. Measuring Different parameters of the Signal using DPO.

3. Observing & Measuring Bus Signal Timing Parameters and Identifying Machine Cycles using Mixed Signal Oscilloscope.

4. Measuring Different parameters of the Signal using Arbitrary Waveform Generator.

5. Measuring Different parameters of the Signal using Function Generator.

6. Measuring Different parameters of the Signal using Vector Signal Generator.

7. Peak power, Noise power density measurement using spectrum analyzer.

8. Peak power, Noise power density measurement using real time spectrum analyzer.

9. Analyzing passive and active components such as filters, amplifiers, mixers and multiport modules using Vector Network Analyzer.

10. Electromagnetic disturbance measurements using EMI Test Receiver.

11. Measuring Total Harmonic Distortion using LabVIEW.

Digital Signal Processing

Teaching Scheme
Lectures: 3 hrs/week

Examination Scheme
100 marks: Continuous evaluation-
Assignments / Quiz- 40 Marks
End-Sem Exam - 60

Unit 1: DSP Preliminaries (8hrs)

Sampling, DT signals, sampling theorem in time domain, sampling of analog signals, recovery of analog signals, and analytical treatment with examples, mapping between analog frequencies to digital frequency, representation of signals as vectors, concept of Basis function andorthogonality. Basic elements of DSP and its requirements, advantages of Digital over Analog signal processing.

Unit 2: Discrete Fourier Transform (8hrs)

DTFT, Definition, Frequency domain sampling, DFT, Properties of DFT, circular convolution, Linear convolution, Computation of linear convolution using circular convolution, FFT, decimation in time and decimation in frequency using Radix-2 FFT algorithm, Linear filtering using overlap add and overlap save method, Introduction to Discrete Cosine Transform.

Unit 3: IIR Filter Design (8hrs)

Concept of analog filter design (required for digital filter design), Design of IIR filters from analog filters, IIR filter design by approximation of derivatives, , IIR filter design by impulse invariance method,Bilinear transformation method, warping effect. Characteristics of Butterworth filters, Chebyshev filters and elliptic filters, Butterworth filter design, IIR filter realization using direct form, cascade form and parallel form, Finite word length effect in IIR filter design

Unit 4: FIR Filter Design (8hrs)

Ideal filter requirements, Gibbs phenomenon, windowing techniques, characteristics and comparison of different window functions, Design of linear phase FIR filter using windows and frequency sampling method. FIR filters realization using direct form, cascade form and lattice form, Finite word length effect in FIR filter design

Unit 5: Multirate DSP (6hrs)

Concept of Multirate DSP, Sampling rate conversion by a non-integer factor, Design of two stage sampling rate converter

Unit 6: (6hrs)

Application of DSP to real systems like Voice Processing, Music processing, Image processing and Radar processing.

Text Books

- John G. Proakis, Dimitris G. Manolakis, " Digital Signal Processing: Principles, algorithms and Applications" Fourth edition, Pearson Prentice Hall.
- Ifaeachor E.C, Jervis B. W., Digital Signal processing : Practical approach, Pearson Publication.

Reference Books

- Dr. Shaila Apte, Digital Signal Processing Wiley India Publication, second edition.
- K.A. Navas, R. Jayadevan, Lab Primer through MATLAB, PHI
- Li Tan, Jean Jiang, Digital Signal Processing : Fundamentals and applications Academic press,
- S. Salivahanan, C. Gnanpriya, Digital Signal processing , McGraw Hill

Course Outcomes:

After successfully completing the course students will be able to:

1. Understand use of different transforms and analyzes the discrete time signals and systems and realize the use of LTI filters for filtering different real world signals.
2. Capable of calibrating and resolving different frequencies existing in any signal and design to implement multistage sampling rate converter.
3. Applying knowledge to various real time cases.

Digital Communication Systems

Teaching Scheme
Lectures: 3 hrs. /week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks
End-Sem Exam - 60

Unit 1 **(8 hrs)**

Detection and Estimation:

Introduction to principles and block schematic of digital communication system, Review of Random Processes, Gaussian Process, Correlation Functions and Power Spectra, Gram-Schmidt Orthogonalization Procedure, Geometric Interpretation of Signals, Response of Bank of Correlators to Nosiy Input, Detection of Known Signals in Noise, Probability of Error, Correlation Receiver, Matched Filter Receiver. Estimation: Concepts and Criteria, Maximum Likelihood Estimation

Unit 2 **(8 hrs)**

Sampling Process and Waveform coding techniques:

Sampling theorem, Practical difficulties in signal reconstruction, Aliasing effect, Pulse code modulation (PCM), Bandwidth and output SNR analysis of PCM.Uniform and non-uniform quantization, Companded PCM, Differential PCM (DPCM), Delta modulation (DM), Adaptive delta modulation (ADM), Performance comparison of the above systems with PCM.

Unit 3 **(8 hrs)**

Base band shaping for Data Transmission:

Discrete PAM Signals, Inter-symbol interference (ISI), Eye pattern, Channel equalization.

Detection of binary signals in Gaussian Noise, Detection error Probability for polar, on-off and bipolar signals

Unit 4 **(4 hrs)**

Bandpass modulation techniques I:

Digital Band pass Modulation techniques such as ASK, FSK, BPSK, QPSK, QAM etc, Bandpass demodulation in the presence of Gaussian noise.

Unit 5 **(5 hrs)**

Bandpass modulation techniques II:

Coherent and non-coherent detection, Error performance for binary system, M-ary signaling and performance, Bit error rate (BER) performance of shift-keying techniques, Introduction to OFDM

Unit 6 **(7 hrs)**

Spread Spectrum techniques:

Spread spectrum principles, Pseudo-noise (PN) sequences, Direct-sequence and frequency hopping spread spectrum (DSSS and FHSS) systems, Jamming considerations, Orthogonality between PN-codes, CDMA, Commercial applications of spread spectrum - Cellular systems and GPS.

Text Books

- Simon Haykin, "Digital Communications", John Wiley and Sons.
- B.P.Lathi and Zhi Ding, "Modern Digital and Analog Communication Systems", (Fourth edition), Oxford University Press.

Reference Book

- Bernard Sklar, "Digital Communications - Fundamentals and Applications", Pearson Education Asia.
- K. N. Hari Bhat and D. Ganesh Rao, "Digital Communications – Theory and Lab Practice", Third Edition, Pearson.
- V. Chandra Sekar, "Communication Systems", Oxford University Press.

Course Outcomes:

After successfully completing the course students will be able to:

1. Analyze the digital communication receivers in the presence of noise.
2. Analyze the performance of waveform coding techniques.
3. Compare the bandpass modulation techniques for bit error rate, bandwidth and power.
4. Analyze the spread spectrum techniques.

Computer Architecture

Teaching Scheme
Lectures: 3 hrs. /week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks
End-Sem Exam - 60

Unit 1

Introduction to computer organization: (6hrs) Architecture and function of general computer system, CISC Vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating point representation and arithmetic, Control unit operation, Hardware implementation of CPU with Micro instruction, Microprogramming, System buses, Multi-bus organization.

Unit 2

Memory organization: (6hrs) System memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit , Magnetic Hard disks, Optical Disks.

Unit 3

Input – output Organization: (8hrs) Accessing I/O devices, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Arbitration, Multilevel Bus Architecture, Interface circuits - Parallel and serial port. Features of PCI and PCI Express bus.

Unit 4

16 and 32 microprocessors: (8hrs)

80x86 Architecture, IA – 32 and IA – 64, Programming model, Concurrent operation of EU and BIU, Real mode addressing, Segmentation, Addressing modes of 80x86, Instruction set of 80x86, I/O addressing in 80x86

Unit 5

Pipelining: (8 hrs) Introduction to pipelining, Instruction level pipelining (ILP), compiler techniques for ILP, Data hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on instruction set.

Unit 6

Different Architectures:

VLIW Architecture, DSP Architecture, SoC architecture, MIPS Processor & programming

Text Books

- V. Carl, Zvonko G., Safwat G.Zaky, “Computer organization”, McGraw - Hill, international Edition.
- Barry Brey & C.R. Sarma, “The Intel microprocessors”, Pearson Education
- John L. Hennessy , David A. Patterson “Computer Architecture A Quantitative Approach”, Fourth Edition

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Reference Books

- William Stalling, "Computer organization", PHI, Fourth Edition.
- Peter Barry and Patric Crowley, "Modern Embedded Computing", Morgan Kaufmann.
- N. Mathivanan, "Microprocessors, PC Hardware and Interaction", Prentice Hall.
- Yu-Cheng Lieu & Glenn A. Gibson, "Microcomputer Systems: The 8086/8088 Family", Prentice Hall India.
- John Uffenbeck, "The 8086/8088 Design, Programming, Interfacing", Prentice Hall India
- B. Govindarajalu, "IBM PC and Clones", Tata McGraw Hill, Second Edition.
- Peter Able, "8086 Assembly Language Programming", Prentice Hall India.

Outcomes:

After successfully completing the course students will be able to:

1. Provide a good foundation on microprocessors, their principles and practices.
2. Write efficient programs in assembly language of the 8086 family of microprocessors.
3. Organize a modern computer system and be able to relate it to real examples.
4. Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.
5. Implement embedded applications using ATOM processor.

Electromagnetic waves

Teaching Scheme:
Lectures: 3 hrs/week

Examination Scheme:

100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks.
End-Sem Exam – 60.

Unit 1 **(10 hrs)**

Transmission Lines: Introduction, Concept of distributed elements, Equations of voltage and current, Standing waves and impedance transformation, Lossless and low-loss transmission lines, Power transfer on a transmission line, Analysis of transmission line in terms of admittances, Transmission line calculations with the help of Smith chart, Applications of transmission line, Impedance matching using transmission lines.

Unit 2 **(5 hrs)**

Maxwell's Equations: Basic quantities of Electromagnetics, Basic laws of Electromagnetics: Gauss's law, Ampere's Circuital law, Faraday's law of Electromagnetic induction. Maxwell's equations, Surface charge and surface current, Boundary conditions at media interface.

Unit 3 **(7 hrs)**

Uniform Plane Wave: Homogeneous unbound medium, Wave equation for time harmonic fields, Solution of the wave equation, Uniform plane wave, Wave polarization, Wave propagation in conducting medium, Phase velocity of a wave, Power flow and Poynting vector.

Unit 4 **(6 hrs)**

Plane Waves at Media Interface: Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction of waves at dielectric interface, Total internal reflection, Wave polarization at media interface, Brewster angle, Fields and power flow at media interface, Lossy media interface, Reflection from conducting boundary.

Unit 5 **(6 hrs)**

Waveguides: Parallel plane waveguide: Transverse Electric (TE) mode, transverse Magnetic (TM) mode, Cut-off frequency, Phase velocity and dispersion. Transverse Electromagnetic (TEM) mode, Analysis of waveguide-general approach, Rectangular waveguides.

Unit 6 **(6 hrs)**

Antennas: Radiation parameters of antenna, Potential functions, Solution for potential functions, Radiations from Hertz dipole: Near field, Far field, Total power radiated by Hertz dipole, Radiation resistance and radiation pattern of Hertz dipole, Hertz dipole in receiving mode.

Text Books

- R. K. Shevgaonkar, " Electromagnetic Waves", Tata McGraw Hill.

Reference Books

- David K. Cheng, Field and Wave Electromagnetics", 2nd Edition, Pearson.
- Matthew N.O. Sadiku, Elements of Electromagnetics", 4th Edition, Oxford University Press.
- Constantine A. Balanis, Advanced Engineering Electromagnetics", John Wiley & Sons.
- Constantine A. Balanis, Antenna Theory: Analysis and Design", John Wiley & Sons

Course Outcomes:

After successfully completing the course students will be able to:

1. Analyze the transmission lines and estimate voltage and current at any point on transmission line for various load conditions.
2. Provide solution to real life plane wave problems for various boundary conditions using concepts of electromagnetic wave propagation.
3. Evaluate the field equations for the wave propagation in special cases such as lossy and low loss dielectrics medium.
4. Visualize TE and TM mode patterns of field distributions in rectangular waveguide.
5. Analyze the basics of Hertz dipole antenna.

Digital Signal Processing Lab

Teaching Scheme
Practical: 2 hrs./week

Examination Scheme
Term-work: 50 Marks
Oral: 50 Marks

List of Experiments:

1. Generation of Analog Signals using C and MATLAB.
2. Generation of Discrete sequences in C and MATLAB.
3. Verification of linear convolution in C and MATLAB using two finite sequences.
4. Programming for circular convolution in C and MATLAB.
5. Generation of signal. Generate a noise signal. Mix both the signals. Design a Filter. Recovery of original signal using filter.
6. Design of FIR filter in C and MATLAB.
7. Design of IIR filter in C and MATLAB.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Apply concept of DSP to varied problems of different domains like medical, astronomical, and military and so on.
2. Program Digital filter for specific application.
3. Interfacing of DSP processors with PC.
4. Get aquatint with different DSP processors for basic application.

Digital Communication Systems Laboratory

Teaching Scheme
Practical: 2 hrs./week

Examination Scheme
Term-work: 50 Marks
Oral: 50 Marks

List of Experiments:

1. Sampling & reconstruction.
2. PCM-TDM system.
3. Differential PCM system.
4. Delta Modulation (DM) system.
5. Adaptive Delta Modulation (ADM) system.
6. Companded PCM (A law & □ law).
7. Data formatting (Line Codes).
8. Shift Keying Techniques - I - ASK & FSK.
9. Shift Keying Techniques – II - BPSK & QPSK.
10. Direct Sequence Spread Spectrum (DS-SS).
11. Simulation assignments using tools such as MATLAB and CommSIM including Monte Carlo Simulation for Digital Communication Systems.

Lab Outcomes:

At the end of this course students will demonstrate the ability to:

1. Perform simple experiments with a purpose-build hardware platform, obtain and analyse results relevant for system performance, and report their findings in a systematic form.

2. Develop and use simple software modules (e.g., using CommSIM and Matlab) for implementing basic techniques in modern digital communications to numerically evaluate and analyse small-scale modules of communications systems, and report the simulation results.

3. Compare different techniques in digital communications, and judge the applicability of different techniques in different situations.

Computer Architecture lab

List of Experiments:
(programs to be written in C)

1. To find area of triangle using sequential multiplication method.
2. To sort leap years from an array (One century).
3. To divide 32 bit dividend by 8/16 bit divisor.
4. To convert invalid BCD numbers to valid BCD numbers and arrange them in ascending order. (Range: 00 to 99).
5. To display string using INT 21H.
6. To convert upper case to lower case (String given by programmer).
7. To convert lower case to uppercase (String given by user)
9. To study INT 50 H.
10. To display string using Delay.
11. To sort elements of an array using SPIM simulator for MIPS processor.

Lab Outcomes:

At the end of this course students will demonstrate the ability to:

1. Write efficient programs in assembly language of the 8086 family of microprocessors.
2. Develop the programs in assembly language, Real mode, protected mode of processors.
3. Develop the program in assembly language for MIPS architecture.

SEMESTER VI

Sr. No	Course Type	Course Name	Teaching Scheme			Credits
			L	T	P	
1	SLC	Technical MOOC/Internship/Industry floated Course: this could be an elective Six to Eight weeks internship/ MOOC on Numerical methods	3	0	0	3
2	MLC	Environmental Studies	1	0	0	0
3	ILOE in Humanities/ HSMC	Institute will offer courses (select any one in line with V semester) • English Language Proficiency-II • Finance for Engineers -II • Engineering economics-II • Industrial Psychology-II • Personal Psychology-II • Japanese Language-II • German Language-II	2	0	0	2
4	SBC	Skill based course: Mini-Project	1	0	2	2
5	PCC1	Information Theory and Coding	3	0	0	3
6	PCC2	Power Electronics	2	1	0	3
7	PCC3	Configurable design and verification	3	0	0	3
8	PEC	Department Elective-I	3	0	0	3
9	LC1	Information Theory and Coding Lab	0	0	2	1
10	LC2	Power Electronics Lab	0	0	2	1
11	LC3	PLDs and Applications Lab	0	0	2	1
			18	1	8	
		Total Academic Engagement and Credits				22

Department Elective- I

1. Image Processing
2. Antenna & radiating systems
3. System programming and operating systems
4. Control systems

Environmental Studies

Teaching scheme: ONE interactive session per week (TOTAL – 12 lectures including field work like exposure visit/ interaction/ actual contribution/ small project etc.)

Credits: In the revised syllabus this is an AUDIT Course (ONE lecture per week).

Unit 1. **(2hrs)**

The Global environmental issues

Human population and environment : Population growth, Environment and human health,Women and child welfare.

Social issues and environment : People and environment, Social consequences of development and Environmental changes.

Unit 2. **(2hrs)**

Natural resources

Concept, spheres, Direct & Indirect utilization of natural resources, Types - Renewable and non-renewable, Overexploitation & pollution, Conservation - 3R principle.

Unit 3. **(4hrs)**

Ecosystem

Concept, Types – Terrestrial & aquatic with subtypes, Function, Food chain & web, Energy pyramid, Niche, Ecotone.

Unit 4. **(4hrs)**

Biodiversity

Introduction, levels, Types, Distribution & Magnitude, Threats, Conservation

Unit 5. **(4hrs)**

Pollution

Concept, Types & Sources, Direct & indirect Impacts, Prevention, control and mitigation measures, Disaster management.

Unit 6. **(4hrs)**

Environmental rules and regulations

Concepts, Local, national and Global level framework, tools like Environmental Impact Assessment, Environmental Management System, Certifications, Role of an engineer in environmental management.

Text books:

- Bharucha, E. (2013) Textbook of Environmental Studies for Undergraduate Courses.
- Rajgopalan, R (2011) Environmental Studies: From Crisis to Cure. Oxford University Press
- Wright, RT (2007) Environmental Science. Pearson Education (Low Prise 9th Edition) 712 p.

Reference books:

- Carson, Rachel (1962) The Silent Spring
- Leelakrishnan, P. (2006) Environmental Law Case Book (IInd Edition) LexisNexis Butterworths (Student Serise) 466 p.
- McKibben, Bill (1989) The end of Nature
- Meadows, Donella, Meadows Dennis & Randers Jorgen (1996) Beyond the limits
- Odum, EP (1971) Fundamentals of Ecology, W.B. Saunders (Publi.). 574 p.
- United Nations Environment Program (2005) Atlas of Our Changing Environment
- Weisman, Alan (2007) The World without us

Important web resources:

Official websites of UNEP, UNESCO, MoEFCC, various NGO's

Course Outcomes

1) Students will understand the concept of environment and its importance for the mankind.
2) Students will also become aware of the current issues and environmental problems at local, national and global level.
3) Students will be sensitized towards the protection, conservation and sustainable development
4) Students will think seriously about the impact human actions on environment and measures to minimize and mitigate them as an engineer.
5) Students will learn about their role as professionals in protecting the environment from degradation.

Mini-Project

Teaching Scheme	**Examination Scheme**
Tutorial: 1Hr/week	Term work: 50 Marks
Practical: 2Hrs/ week	Oral: 50 Marks

Guidelines:

1. The mini-project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.
3. Mini Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within first week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.
9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

Course Outcomes:

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

1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
2. Design, implement and test the prototype/algorithm in order to solve the conceived problem.
3. Write comprehensive report on mini project work.

Information Theory and Coding

Teaching Scheme

Lectures : 3 Hrs/week

Examination Scheme

100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks
End-Sem Exam - 60

Unit 1 **(4hrs)**

Information Measures:

Discrete Source models – Memoryless and Stationary, Mutual Information, Self Information, Conditional Information, Average Mutual Information, Entropy, Entropy of the block, Conditional Entropy, Information Measures for Analog Sources

Unit 2 **(8hrs)**

Coding Techniques for Discrete Sources:

For Memory-less Sources: Fixed length coding, Variable length coding – Prefix codes, Kraft Inequality, Coding Techniques - Huffman, Shannon-Fano, Higher order extensions, Average code length, Coding efficiency

For Stationary Sources: Lempel-Ziv encoder and decoder, Software implementation of these techniques using appropriate data structures

Unit 3 **(6hrs)**

Coding Techniques for Analog sources:

Optimum quantization, Distortion, Measures, Rate distortion function (RDF), Distortion rate function (DRF), RDF and DRF for Gaussian Source, Upper and Lower bounds on RDF/DRF, Scalar quantization – Uniform, Non-Uniform, Vector quantization, K-means algorithm, Coding techniques taxonomy.

Unit 4 **(10hrs)**

Channel Capacity and Block Codes:

Channel models – Discrete and Waveform, Channel capacity, Introduction to channel coding – Code rate and Redundancy, Linear Block codes - Vector spaces and subspaces, Generator

matrix, Systematic codes, Parity check matrix, Syndrome Testing, Error Correction, Implementation of encoder and decoder, Cyclic codes – Encoding in systematic form, circuit for dividing polynomials, Systematic encoding and error detection with linear feedback shift registers.

Unit 5 **(6hrs)**

Error Detection and Correction Capability of Block Codes

Weight and distance of binary vectors, minimum distance of a linear code, Error detection and correction capability, Erasure correction, Usefulness of the standard array, Estimating code capability, Error detection vs. correction trade-offs, Block codes examples such as Hamming codes, Golay codes.

Unit 6 **(8hrs)**

Convolutional codes:

Convolutional encoding – Connection representation, State representation, Tree Diagram, Trellis Diagram, Convolutional decoding – Maximum likelihood decoding, Algorithms such as Viterbi, Sequential, Feedback, Viterbi decoder implementation, Distance properties, Minimum free distance, Error Correction capacity, Systematic and Nonsystematic codes

Text Books

- Bernard Sklar and Pabitra Kumar Ray, "Digital Communications: Fundamentals and Applications", Pearson Education Asia, Second Edition
- John G. Proakis and Masoud Salehi, "Digital Communications", Tata McGraw Hill, Fifth Edition

Reference Book

- Salvatore Gravano, "Introduction to Error Control Codes", Oxford University Press, First Edition
- Simon Haykins, "Digital Communication", Wiley, Second Edition
- B. P. Lathi, "Modern Digital and Analog Communication Systems", Oxford press, Third Edition

Course Outcomes:

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

1. Design, implement and compare coding techniques for the memoryless and stationary discrete sources.
2. Implement binary block and convolutional channel coding techniques for error detection and correction in both forms viz. hardware and software.
3. Estimate error detection and correction capabilities of block and convolutional channel codes.

Power Electronics

Teaching Scheme
Lectures : 2 hrs./week
Tutorial : 1 hr. / week

Examination Scheme
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks
End-Sem Exam - 60

Unit 1 **(5hrs)**
Characteristics of Semiconductor Power Devices:

Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

Unit 2 **(6hrs)**
Controlled Rectifiers:

Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current, Effect of source impedance, Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Unit 3 **(5hrs)**
Choppers:

Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper

Unit 4 **(5hrs)**
Single-phase inverters:

Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters

Unit 5 **(4hrs)**
Switching Power Supplies:

Overview of Switching Power Supplies, Concept of Buck and Boost converter. Analysis of fly back, forward converters for SMPS. Resonant converters - need, concept of Zero-Voltage and Zero- Current Switching.

Unit 6 **(4hrs)**
Applications:

Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings for Online UPS. Separately excited DC motor drive.

Text Books

- Muhammad H. Rashid, **“**Power electronics**”** Prentice Hall of India.
- Ned Mohan, Robbins, **“**Power electronics**”**, edition III, John Wiley and sons.

Reference Book

- P.C. Sen., **“**Modern Power Electronics**”**, edition II, S.Chand & Co.
- V.R.Moorthi, **“**Power Electronics**”**, Oxford University Press.
- Cyril W., Lander,**”** Power Electronics**”**, edition III,McGraw Hill.
- G K Dubey,S R Doradla,:Thyristorised Power Controllers**”**,New Age International Publishers.
- SCR manual from GE, USA.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Build and test circuits using power devices such as SCR, IGBT and MOSFET.
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters, Learn how to analyze these inverters and some basic applications.
3. Design SMPS.

Configurable design and verification

Teaching Scheme | **Examination Scheme**

Teaching Scheme	**Examination Scheme**
Lectures: (3 hrs)/week	Total marks: 100 marks
	Continuous evaluation / Quiz: 40 Marks
	End-Sem Exam - 60

Unit 1 **(12hrs)**

Synchronous FSM Design: Top down approach to Design, FSM: Mealy & Moore Machines, FSM issues (Starting state, Power on Reset, State diagram optimization, State Assignment, Equivalent states & Minimization Techniques), Vending machines.

Verilog: HDL fundamentals, simulation, and test-bench design, Examples of Verilog codes for combinational and sequential logic.

Static Timing analysis of Sequential circuits, Metastability, clock issues, Synchronizer.

Unit 2 **(6hrs)**

Asynchronous FSM Design: Critical Races, Fundamental mode circuit, Pulsed mode circuit, ASM charts.

Unit 3 **(6hrs)**

Programmable Logic Devices: Introduction, Evolution: PROM, PLA, PAL, GAL, Programming

PLD's, ASIC Design Flow: CPLD's architecture: XC9500 and CoolRunner-II family FPGA Architecture, SoC Architecture.

Unit 4 **(5hrs)**

IP and Prototyping: IP in various forms: RTL Source code, Encrypted Source code, Soft IP, Hard IP, Physical IP, Use of external hard IP during prototyping, Case studies, Speed issues, Low Power Designs Strategies.

Unit 5 **(6hrs)**

RTL code/functional Verification: Basics of verification methodology, System Verilog as HVL (hardware verification language), coverage, assertions, randomization

Unit 6 **(5hrs)**

Design for Testing: Fault models, Different faults, Fault simulation, Boundary scan, Signature Analysis and BIST, JTAG interface.

Text Books

- Donald D Givone, **"**Digital principles and Design**"**, Tata McGRAW-HILL Edition
- Charles Roth, Jr. And Lizy K John, **"**Digital System Design using VHDL**"**, Cengage Learning.

- Samir Palnitkar, "Verilog HDL, a guide to digital design and synthesis", Prentice Hall.

Reference Book

- John P Uyemura, " A First course in Digital System Design – An Integrated Approach", Brooks/Cole Publishing Company.
- Douglas Smith, "HDL Chip Design: A Practical Guide for Designing, Synthesizing & Simulating ASICs & FPGAs Using VHDL or Verilog", Doone publications.
- Bob Zeidman, "Designing with FPGAs & CPLDs", CMP Books.
- IEEE standard HDL based on Verilog HDL, published by IEEE.
- Ben Cohen, "Real Chip design and Verification using Verilog and VHDL", VhdlCohen Publishing
- Stephen Brown and Zvonko Vranesic, " Fundamentals of Digital logic with verilog design", Mc-Graw hill.
- Doug Amos, Austin Lesea, Rene Richter, "FPGA based prototyping methodology manual", xilinx

Course Outcomes

At the end of the course students will demonstrate the ability to:

1. Design the FSM.
2. Write codes using Verilog HDL.
3. Design, Analyze and Verify the systems based on synchronous design on FPGAs.

Department Elective-I

Image Processing

Teaching Scheme:

Lectures: 3 hrs/week

Examination Scheme:

100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks.
End-Sem Exam – 60.

Unit 1 **(4hrs)**

Introduction to image processing: Applications and fields of image processing, Fundamental steps in Digital image processing, Elements of visual perception, Image sensing and acquisition, Basic Concepts in Sampling and Quantization, representing digital images.

Unit 2 **(8hrs)**

Image Enhancement Some basic gray level transformations, Histogram Processing, Histogram modification, Image subtraction, spatial filtering, Sharpening Spatial filters, use of first and second derivatives for enhancement, LoG, Image Enhancement in the Frequency Domain, 2D Fourier transform, Gaussian filters, Homomorphic filtering, Pseudocolouring : intensity slicing, gray level to color transformation.

Unit 3 **(8hrs)**

Image Segmentation : Some Basic Relationships between pixels, point, line and edge detection, Gradient operators, Canny edge detection, pyramid edge detection.

Edge linking and boundary detection. Hough transform, Chain codes, boundary segments, skeletons, Boundary descriptors, Fourier descriptors, morphological operations, Watershed segmentation

Unit 4 **(6hrs)**

Thresholding: The role of illumination, global thresholding, adaptive thresholding, use of boundary characteristics for histogram improvement and local thresholding, Region based segmentation, Region growing, region splitting and merging. Texture based segmentation.

Unit 5 **(9hrs)**

Image Compression: Data redundancies Elements of information, variable-length coding, LZW coding, Bit plane coding, uniform and non uniform Quantizers, predictive coding, Transform coding, Image compression standards; Wavelets and Multi- resolution processing: - Image pyramids, sub-band coding.

Unit 6 (7hrs) Basics of Image restoration, Color image processing

Applications of Image Processing: Finger print analysis, Digital watermarking, Optical character recognition, Biometrics etc.

Text Books:

- Gonzalez & Woods, "Digital Image Processing", Second Edition, Pearson Education, 2003
- Pratt W.K, "Digital Image Processing", Third Edition, John Wiley & Sons, 2001

Reference Book:

- Milan Sonka et al, "Image Processing, Analysis and Machine Vision", Second Edition, Thomson Learning, 2001
- B. Chanda & D. Dutta Majumder, " Digital Image Processing and Analysis", 2001

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Understand and apply knowledge of various transforms (Walsh, Hadamard, Fourier, DCT etc) and probability theory in image processing.
2. Understand digital image processing fundamentals like enhancement, encoding, feature extraction, segmentation and restoration.
3. Analyze, apply and critically evaluate various image processing algorithms appropriate for practical applications.

Antenna & Radiating Systems

Teaching Scheme:
Lectures: 3 hrs/week

Examination Scheme:
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks.
End-Sem Exam – 60.

Course Objectives:

The objective of the course is to

- Enable the students to understand, analyze and design antennas and arrays of varying types.

Unit 1 **(3hrs)**

Introduction: Types of Antenna, Radiation Mechanism, Current distribution on thin wire antenna.

Unit 2 **(8hrs)**

Antenna fundamentals: Antenna Terminology: Radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, half power beam width, bandwidth, antenna polarization, input impedance, antenna radiation efficiency, effective length, effective area, reciprocity, Friis Transmission equation, Antenna Temperature. .

Radiation Integrals: Vector potentials **A, J, F, M**, Electric and magnetic fields electric and magnetic current sources, solution of inhomogeneous vector potential wave equation, far field radiation.

Unit 3 **(7hrs)**

Linear Wire Antennas: Infinitesimal dipole, Small dipole, Region separation, Finite length dipole, half wave dipole, Ground effects. Loop Antennas: Small Circular loop, Circular Loop of constant current, Circular loop with non uniform current.

Unit 4 **(7hrs)**

Linear Arrays: Two element array, pattern multiplication N-element linear array, uniform amplitude and spacing, broad side and end-fire array, N-element array: Uniform spacing, non uniform amplitude, array factor, binomial and dolph chebyshev array.

Unit 5 **(8hrs)**

LF to HF Antennas: Structural details, dimensions, radiation pattern, specifications, features and applications of following antennas: Hertz & Marconi antennas. Effects of ground & antenna height. Electrically short antennas. Beverage antenna. Medium frequency antennas: Tower radiation, construction, feed, ground system. HF antennas: Resonant & non-resonant antennas. Harmonic antenna. V- Antenna. Rhombic antenna. TW antennas. Loop antenna. Ferrite rod antenna. Whip antenna.

Unit 6

VHF to SHF Antennas: Structural details, dimensions, radiation pattern, specifications, features and applications of following antennas: Folded dipole, Yagi-Uda, Biconical, Helical, Horn, Slot, Microstrip, Turnstile, Super turnstile & Lens antennas. Antennas with parabolic reflectors. Cassegrain reflectors.

Text Books:

- C.A. Balanis, Antenna Theory - Analysis and Design", John Wiley.
- E.C. Jordon and E.G. Balman, Electro-magnetic Waves and Radiation Systems, Prentice Hall India.

Reference Books:

- K. D. Prasad, **"**Antenna & Wave Propagation**"**, Satya Prakashan, New Delhi.
- J. D. Kraus, **"**Antennas**"**, Mc Graw Hill.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Compute the far field distance, radiation pattern and gain of an antenna for given current distribution.
2. Estimate the input impedance, efficiency and ease of match for antennas.
3. Compute the array factor for an array of identical antennas.
4. Design antennas and antenna arrays for various desired radiation pattern characteristics.

System Programming and Operating Systems

Teaching Scheme:
Lectures: 3 hrs/week

Examination Scheme:
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks.
End-Sem Exam – 60.

Unit 1 **(6hrs)**

Basics of system programming: Language processors: Language processing activities, Fundamentals of language processing, Fundamentals of language specification, Language processor development tools. Data structures for language processing: Search data structure, Allocation data structures. Scanning and parsing, Assembler: Assembly language programming, simple assembly scheme, pass structure of assembler, design of two pass assembler.

Unit 2 **(6hrs)**

Macro processor, Compliers and Interpreters: Macro definition and call, macro expansion, Machine Independent macro processor features, Nested macro calls, advanced macro facilities, Design of macro preprocessor. Basic compliers function, Phases of compilation, memory allocation, compilation of expression, compilation of expressions, compilation of control structures, code of optimization, interpreter.

Unit 3 **(6hrs)**

Linkers and Loaders and Software tools: Basic loaders functions, central loaders scheme Absolute loaders, Subroutine linkers, relocation. Loader, Direct linking loader, Dynamic linking loader, Design of absolute loaders direct linking loader, Implantation of MS DOS linker, Software tools for program development, editors, debug monitor, programming environment, user interfaces.

Unit 4 **(6hrs)**

Introduction to Operating System, Process and threads and Deadlocks: Evolution of O. S. Function, various OS, OS concepts, OS structure Processes, threads, inter process communication, IPC problems, scheduling Resources, introduction to deadlock, ostrich algorithm, deadlock detection and recovery, avoidance, prevention, other aspects.

Unit 5 **(6hrs)**

Memory management: Basics of memory management, Swapping, Virtual memory, Page replacement algorithm, FIFO, second chance PR, clock PR, least recently used, working set PR, WS clock PR, Design issues for Paging systems, OS involvement with paging, page fault handling, Segmentation.

Unit 6 **(6hrs)**

Input and Output, File system: Review of computer hardware, principles of I/O hardware, principles of I/O software, I/O software layers, disks, clocks, graphical user interface, network terminal, power management Files, directories, file system and implementation, file system layout, implementing files, implementing directories, shared files, disc space management, examples of file system: CDROM, MSDOS, Win98, Unix.

Text Books:

- D. M. Dhamdhere, "Systems Programming and Operating System", TMH.
- Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, PHI.

Reference Books:

- J. J. Donovan, "Systems Programming", McGraw Hill.
- Siberschatz A; Galvin P.B; Gagne G, "Operating System Concepts", John Wiley.
- Leland L. Beck, "System Software," Pearson Editions.

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Design simple editor, pseudo assembler etc.
2. Select and configure OS, file system towards optimizing performance

Control Systems

Teaching Scheme:
Lectures: 3 hrs/week

Examination Scheme:
100 marks: Continuous evaluation-
Assignments /Quiz- 40 Marks.
End-Sem Exam – 60.

UNIT 1. **[6 Hrs]**

System Modeling: Introduction to control system- Basic elements in control system, Open and closed loop control systems, Differential equation representation of physical systems, Transfer function ,Mathematical modeling of electrical and mechanical systems (Translational and Rotational), Analogous system, Block diagram representation of systems, Block diagram reduction techniques, Signal flow graph, control system components-tachometer, dc and ac servomotors, stepper motors.

UNIT 2. **[7 Hrs]**

Time Domain Analysis: Type and Order of the Control Systems , Types of Standard Inputs , Response of First Order System to Step, Ramp and Parabolic Inputs , Second order system – step response analysis- steady state error – generalized error co-efficients , Effect of adding a zero to system- Principle of PI, PD and PID compensation.

Unit 3. **[6 Hrs]**

Stability: Concept of Stability , Absolute ,Relative , Marginal and Unstable Stability analysis in S Plane , Dominant Poles and Zeros , Routh-Hurwitz Criterion , Concept of Root Locus

UNIT 4. **[8 Hrs]**

Frequency Domain Analysis: Frequency response, Frequency domain specifications , Correlation between time domain and frequency domain specifications, Bode plot, Stability analysis using Bode plot, transfer function from bode plot, Polar plot, Nyquist stability criterion.

UNIT 5. **[7 Hrs]**

Digital Control Systems: Introduction, Advantages over analog control system, Sampled Data Control System, Transfer Function of Digital Control System, Step Response (First & Second Order Systems only), Introduction to Digital PID Controller, Introduction to PLC: Block schematic, PLC addressing, any one application of PLC using Ladder diagram. Concept of Offset ,P, PI , PD and PID Characteristics.

UNIT 6. **[6 Hrs]**

State Space Analysis : Advantages of State Space Analysis over Classical Control , Concept of State , State Variables and State Model , State Space Representation using State Model, State Transition Matrix and its properties, Solution of State Equations for LTI System , Concept of Controllability and Observability.

Text Book:

- I.J.Nagrath, M. Gopal, **"**Control Systems Engineering**"**, Fifth Edition, New Age International, New Delhi, 2007.

Reference Books:

- Benjamin C.Kuo, **"**Automatic Control Systems**"**, Seventh Edition, PHI Learning New Delhi, 1997.
- Katsuhiko Ogata, **"**Discrete Time Control Systems**"**, Second Edition, PHI Learning New Delhi, 2006.
- R.Anandanatarajan, P. Ramesh Babu, **"**Control Systems Engineering**"**, Second edition, Scitech Publications Pvt. (India) Ltd, 2008

Course Outcomes:

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

1. Model a physical system and express its internal dynamics and input-output relationships by means of block diagrams, mathematical model and transfer functions.
2. Understand and explain the relationships between the parameters of a control system and its stability, accuracy, transient behavior.
3. To determine the stability of a system and parameter ranges for a desired degree of stability.
4. Plot the Bode, Nyquist, Root Locus diagrams for a given control system and identify the parameters and carry out the stability analysis.
5. Model and analyze the control systems using state space analysis.

Information Theory and Coding Lab

Teaching Scheme
Practical : 2 Hrs/week

Examination Scheme
Term work: 50 Marks, Oral: 50 Marks

Course Outcomes:

At the end of the lab course, students will demonstrate the ability to:

- Design and deploy various encoding and decoding techniques for discrete sources using programming languages such as C/C++.
- Build the hardware and evaluate performance of block and convolutional encoders and decoders.

List of Assignments/Experiments:

1. Entropy computations – Average Self Information (Entropy), Conditional entropy, Average Mutual information for binary and M-ary sources.
2. Design and Implement Huffman encoder and decoder for the given string.
3. Design and Implement Shannon-Fano encoder and decoder for the given string.
4. Design and Implement Lempel-Ziv-Welch encoder and decoder for the given string.
5. Build and test the performance of Linear Block Codes: Encoder and Decoder.
6. Build and test the performance of Cyclic Codes: Encoder and Decoder
7. Build and test the performance of Convolution Codes: Encoder and Decoder

***NOTE:** The programming is to be carried out using C, C++. The hardware implementation is to be done using digital circuits/kits available in the lab.)*

Power Electronics Lab

Teaching Scheme
Practical: 2 hrs./week

Examination Scheme
Term-work: 50 Marks
Oral: 50 Marks

List of Experiments:

1. Study of Power Devices and its characteristics: SCR, Triac, Diac.
2. Study of Power Devices and its characteristics: Power MOSFET and IGBT.
3. Study of R, RC triggering methods for a SCR.
4. Study UJT triggering method for a SCR.
5. Measurement of Latching and Holding current of SCR.
6. Study of dv/dt limitation circuits for power devices.
7. Forced Commutation methods: class C and class D.
8. SCR converters and reactive loads.
9. Line commutated converters: Inverter operation and measurement of overlap angle.
10. Parallel capacitor commutated (Type A/Class D)Step down chopper.
11. Step up chopper.
12. Study of two quadrant Type C/Type D or study of four quadrant Type E chopper.
13. Single phase PWM inverter: measurement of frequency Vs output for resistive and inductive loads.
14. Design of SMPS and regulation characteristics of SMPS.
15. Regulation characteristics of DC Motor, demonstration of ramp up/ ramp down and field failure protection.
16. Three phase diode bridge rectifier.
17. Applications in power electronics.
    D C Static Switch, Crowbar circuit, lamp dimmer and fan control circuit
18. Applications in power electronics: Stabilizer, On Line UPS.

Mini Project Work:
Design of complete system in power electronics
Viz. – Converters, Inverters, SMPS, Resonant converters, UPS, AC/DC Drives, Chopper, Stepper Motor control etc.

* Any Eight Experiments to be conducted in laboratory for conduction of practical examination.
* Mini Project work will be done in the batch of 4 students each and will be assessed for term work.

Lab Outcomes:

At the end of this laboratory course students will demonstrate the ability to:

1. Design and implement various triggering and turn off circuits for power devices as, SCR, Power MOSFET, IGBT.
2. Interpret the efficiency and switching losses in power converter.
3. Understand concepts of active, reactive and RLE loads, regulation characteristics in SMPS and drives.
4. Understand and implement various applications in power electronics in terms of mini project work.

Configurable design and verification Lab

Teaching Scheme

Practical: 2 hrs./week

Examination Scheme

Mini Project: 50 Marks
Practical: 50 Marks

Mini Project Demonstration (Coding, Downloading) = 50 marks

Practical exam = 50 marks

Lab Journal: In the form of CD (Should contain Coding, snapshots of result, synthesis report, RTL view. For downloaded program, pre & post synthesis & implementation reports)

List of experiments

1	VHDL implementation of Full Adder/Subtractor, 4 bit adder, Shift Register, 3 bit Synchronous Counter(up/down, ring, Johnson), ALU.
2	Verilog implementation of 8:1 Mux / Demux, Full Adder, 8-bit magnitude comparator, encoder / decoder, priority encoder, D FF, 4 bit Shift registers(SISO, SIPO, PISO, bidirectional), 3 bit Synchronous Counters, binary to gray converter, parity generator.
03	Sequence generator / detectors, Synchronous FSM – Mealy and Moore machines.
04	Vending machines - Traffic Light controller, ATM, elevator control.
5	PCI Bus and Arbiter and downloading on FPGA.
6	Realization of single port SRAM in Verilog.
7	Verilog implementation of Arithmetic circuits like serial adder/subtractor, parallel adder/subtractor, serial/parallel multiplier.
8	Discrete Fourier transform or Fast Fourier Transform algorithm in verilog.
9	UART / USART implementation in verilog.
10	Writing verification code for ALU.

Apart from this, mini project demonstrations by students (in group of 4) on various topics like:

1. Electrostatic precipitator controller for FPGA implementation
2. Variable length coder for FPGA implementation of JPEG / MPEG Codec.
3. Real Time Clock with Stopwatch on FPGA Board.
4. RISC Microprocessor
5. Wrist watch

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Know the basic information about programmable systems.
2. Implement Boolean functions, combinative and sequential functions in the FPGA.
3. Know the structure and operation of FPGA and SoC
4. Have the clear understanding of all three paradigms of implementation of digital logic circuits
   a. using fixed function ICs   b. using programmable logic   c. using ASIC

Department of Electronics and Telecommunication Engineering
College of Engineering, Pune

A.Y. 2017-18 w.e.f. July 2017

Minor in IOT

Note:
Internet of Things is a new revolution of internet that is rapidly gathering momentum driven by advancement in Sensor networks, Mobile devices, Wireless communication, Networking and cloud technologies.
The scope of this subject is to offer broader perspective of IOT. In this program, Raspberry Pi (one of the open source environment) is used for rapid prototyping IOT applications using Python.
Here, IOT domains like Home Automation, Smart Cities, Environment (weather monitoring) and Agriculture (smart irrigation) are explored.

Semester V
Microcontrollers

Teaching Scheme	**Examination Scheme**
Lectures : 3 Hrs/week	T1, T2/Assignments: 20 Marks each
	End-Sem. Exam: 60 Marks

Course Outcomes:
At the end of this course, students will demonstrate the ability to
1. Understand Arduino programming with C++.
2. Understand python programming with Raspberry Pi
3. Able to Design Smart systems applications.
4. Learn and understand about any new IDE, compiler, and MCU chip in hardware platforms available or similar types.

Unit 1 **[06 Hrs]**
Microprocessor Microcontroller architecture
Introduction of Microprocessor Microcontroller, Architecture and Role of microcontroller in Embedded System and Internet of Things (IoT)

Unit 2 **[06 Hrs]**
Microcontrollers in IOT
Microcontrollers used in IoT open source environment, design issues, operating conditions and requirements, platform details

[06 Hrs]

Unit 3

Introduction to Arduino- AVR microcontroller, Overview of Architecture and peripheral connectivity, associated software and development tools for the platform **Arduino- AVR microcontroller**

Unit 4 **[06 Hrs]**

Raspberry Pi- ARM processor

Introduction to Raspberry Pi- ARM processor, Overview of Architecture and peripheral connectivity, associated software and development tools

Unit 5 **[06 Hrs]**

Intel Galileo platform

Introduction to Intel Galileo platform - Quark processor, Overview of Architecture and peripheral connectivity like SPI, I2C, Serial, associated software and development tools for the platform

Unit 6 **[06 Hrs]**

Case studies using microcontrollers:

Case studies using above microcontrollers, various design options such as interfacing of switches, LEDs, Key pad, LCD

Text books:

- AVR Microcontroller and Embedded Systems: Using Assembly and C, By Mazidi, Naimi, Naimi, First Edition, Pearson
- Internet of Things with Arduino Blueprints, by Pradeeka Seneviratne, Packt Publishing Limited , 27 October 2015

Web Reference:

http://www.mouser.in/applications/open-source-hardware-galileo-pi/

Semester VI
Network protocols

Teaching Scheme
Lectures : 3 Hrs/week

Examination Scheme
Test1, Test2: 20 Marks each
End-Sem. Exam: 60 Marks

Course Outcomes:
At the end of this course, students will demonstrate the ability to

1. Explain data transmission, network layer, session and application layer protocols and their role in network communications
2. Provide overview of popular protocols and standards helping IoT device applications

Unit 1 **[06 Hrs]**
Introduction to protocols for Internet of Things (IoT)
Introduction to protocols for Internet of Things, role, requirements, specifications of protocols in IoT environment, IoT ecosystem, protocol layers in IoT, LoRa protocol for physical layer in IoT

Unit 2 **[06 Hrs]**
Protocols for data link layer
Study of Protocols for data link layer: IEEE 802.11 ah, IEEE 802.15.4 e, WiFi, Bluetooth, Bluetooth Low energy, Z-wave, Zigbee, WirelessHART (advanced encryption technique): architecture

Unit 3 **[06 Hrs]**
Protocols for Network layer
Study of Protocols for Network layer: RPL, 6LoWPAN- IPv6 over Low power Wireless Personal Area Networks, IPV6- end-to-end datagram transmission across multiple IP networks., IPV6 over Bluetooth Low energy

Unit 4 **[06 Hrs]**
Protocols for Session, application layer
Study of MQTT and COAP protocol for IoT applications
- MQTT-protocol designed for M2M and mobile applications,
- COAP- used in resource-constrained internet devices

Unit 5 **[06 Hrs]**
Security in IoT protocols
Need of security, security mechanisms built in the IoT protocols, Trusted Computing Group (TCG) storage interface Interaction Specification

Unit 6 **[06 Hrs]**
IoT Management layer protocols
IoT Management layer protocols need and functioning in order to facilitate communication between different layers in IoT

Text books:

- The Internet of Things: Key Applications and Protocols, by David Boswarthick, Omar Elloumi Olivier Hersent, Wiley, 2015.

Reference Books:

- H. Karl and A. Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, India, 2012

Semester VII
Wireless sensor networks

Teaching Scheme
Lectures : 3 Hrs/week

Examination Scheme
Test1, Test2: 20 Marks each
End-Sem. Exam: 60 Marks

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Design wireless sensor network system for different applications under consideration.
- Understand the hardware details with different types of sensors and select right type of sensor for various applications.
- Understand radio standards and communication protocols to be used for wireless sensor network based systems and applications.
- Use operating systems and programming languages for wireless sensor nodes,
- Handle special issues related to sensors like energy conservation and security challenges

Unit 1 **[06 Hrs]**

Introduction and overview of wireless sensor network (WSN)

Introduction and overview of sensor network architecture, challenges and its applications, wireless sensor network comparison with Ad Hoc Networks, network architecture details

Unit 2 **[06 Hrs]**

Sensor node hardware and Operating System requirements

Study of Sensor nodes, Hardware details of sensor nodes, study based on transceivers, controllers, storage, examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT,
Operating Systems features for WSN, operating systems examples: tinyOS, MANTIS, Contiki, and RetOS.
Programming tools: C, nesC.

Unit 3 **[06 Hrs]**

Protocols requirement for WSN

Overview of sensor network protocols, features of protocols for different types of layers including Physical, MAC and routing/ Network layer protocols, higher layer protocols.

Unit 4 **[06 Hrs]**

Localization and positioning related to WSN

Localization related sensor node connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid technology.

Unit 5 **[06 Hrs]**

Data dissemination and processing in WSN

Differences between sensor network database compared with other database management systems, data storage techniques; query processing techniques in WSN.

Unit 6 **[06 Hrs]**

Specialized features for wireless sensor network

Study of Energy saving and network efficiency for WSN; security challenges and security features requirement for WSN

Text books:

- H. Karl and A. Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, India, 2012.

Reference Books:

- C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, "Wireless Sensor Networks", Springer Verlag, 1st Indian reprint, 2010.
- F. Zhao and L. Guibas, "Wireless Sensor Networks: An Information Processing Approach", Morgan Kaufmann, 1st Indian reprint, 2013.
- Yingshu Li, MyT. Thai, Weili Wu, "Wireless sensor Network and Applications", Springer series on signals and communication technology, 2008.

Semester VIII
IOT architecture

Teaching Scheme
Lectures : 3 Hrs/week

Examination Scheme
T1, T2/Assignments: 20 Marks each
End-Sem. Exam: 60 Marks

Course outcomes:
At the end of this course, students will demonstrate the ability to

- Identify need of IoT technologies for today's need, and system requirement in certain scenarios.
- Understand the types of technologies that are available and in use today and can be utilized to implement IoT solutions.
- Apply these technologies to tackle scenarios in terms of using an experimental platform for implementing prototypes and testing them as running applications.

Unit 1 **[06 Hrs]**
Introduction to Internet of Things
Building blocks of IOT enabling technologies, characteristics of IOT systems, Physical and Logical design of IoT, Data acquisition using sensors, camera, GPS, Smart phone

Unit 2 **[06 Hrs]**
IoT and Machine to Machne (M2M)
Differences and similarities between IoT and M2M, Software Defined Networking (SDN) and applications, Big data, Data Analytics: Hadoop

Unit 3 **[06 Hrs]**
IoT platform design Methodology
Purpose and Requirements specification for IoT, operational view specification, application development

Unit 4 **[06 Hrs]**
Introduction to cloud storage for IoT
Introduction to the use of cloud platforms and frameworks for developing different IoT applications

Unit 5 **[06 Hrs]**
Internet of Things Privacy, Security and Governance
Introduction, Overview of Governance, Privacy and Security Issues, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities

Unit 6 **[06 Hrs]**

Case Studies illustrating IoT design

i. Home Automation – Smart Lighting
ii. Smart City: Smart Parking
iii. Environment: Weather monitoring system
iv. Agriculture: Smart Irrigation
v. Health care
vi. Robotics

Text books:

- A Bahaga, V. Madisetti, "Internet of Things- Hands on approach", VPT publisher, 2014.

Reference books:

- McEwen, H. Cassimally, "Designing the Internet of Things", Wiley, 2013.
- Samuel Greenguard, "Internet of things", MIT Press.

Web resources:

- http://www.datamation.com/open-source/35-open-source-tools-for-the-internet-of-things-1.html
- https://developer.mbed.org/handbook/AnalogIn
- http://www.libelium.com/50_sensor_applications/
- M2MLabs Mainspring http://www.m2mlabs.com/framework

List of Honors Courses to be offered from A.Y. 2017-18:
Communication

Sr. No.	Semester	Title of the Course : **Honors' in Communication**	Pre-requisite if any	Remarks if any
1	V	Statistical Information processing	--	Only E&TC students are eligible
2	VI	Advances in digital communication	Digital communication	
3	VII	Cognitive radio	Digital communication	
4	VIII	High performance networks	Computer networks	

The details for the subjects are to be viewed from our website under revised syllabus of **MTech in Wired and wireless communication**