NOIDA INTERNATIONAL UNIVERSITY

EVALUATION SCHEME & SYLLABUS

For

UNDERGRADUATE DEGREE COURSE

IN

ELECTRONICS & COMMUNICATION ENGINEERING

(Effective from the Session: 2020-21)

B. Tech in Electronics and Communication Engineering

Program Educational Objectives (PEOs)

The Department of Electronics and Communication Engineering has developed and maintained a well-defined set of educational objectives and desired program outcomes. Educational objectives of the program cater to the requirements of the stakeholders such as students, parents, employers, alumni, faculty etc. The program educational objectives are as follows:

- **PEO**1: Provide graduates with a strong foundation in mathematics, science and engineering fundamentals to enable them to devise and deliver efficient solutions to challenging problems in Electronics, Communications and allied disciplines.
- **PEO**2: Impart analytic and thinking skills to develop initiatives and innovative ideas for R&D, Industry and societal requirements.
- **PEO**3: Provide sound theoretical and practical knowledge of E&C Engineering, managerial and entrepreneurial skills to enable students to contribute to the well-being of society with a global outlook.
- **PEO**4: Inculcate qualities of teamwork as well as social, interpersonal and leadership skills and an ability to adapt to evolving professional environments in the domains of engineering and technology.
- **PEO**5: Motivate graduates to become good human beings and responsible citizens for the overall welfare of the society.

Program outcomes (POs)

Engineering Graduates will be able to:

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

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

PO3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering 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.
PO12**. 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

On completion of B.Tech. ECE program, graduates will be able to:
PSO1.
To identify the engineering problems and develop solutions in the area of communication, signal processing, VLSI and embedded systems.
PSO2.
To demonstrate proficiency in utilization of software and hardware tools along with analytical skills to arrive at appropriate solutions
PSO3.
Incorporate the socio-responsible electronics and communication engineer with leadership, teamwork skills and exhibit a commitment to the lifelong learning.

Credit Distribution

Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week 1 Hours Practical(Lab)/week	0.5 credits 1 credit

Range of credits:

A range of credits from 150 to 160 for a student to be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honors, if he/she completes an additional 20 credits. These could be acquired through MOOCs.

Course code and definition

Course code	Definitions
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
MC	Mandatory Course
OE	Open Elective
EC	Program Core
ECEL	Program Elective

Structure of Undergraduate Engineering program:

S.no	Category	Credits
1	Humanities and Social Sciences including Management courses	12
2	Basic Science courses	26
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	20
4	Professional core courses	51
5	Professional Elective courses relevant to chosen specialization/branch	21
6	Open subjects – Electives from other technical and /or emerging subjects	12
7	Project work, seminar and internship in industry or elsewhere	14
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	Non-credit
Total		**156**

FIFTH SEMESTER

S. No	Course Code	Subject	Period			Evaluation Scheme					Total Credits
						Sessional Exam			End Exams	Subject Total	
			L	T	P	CA	TA	Total			
THEORY											
1	EC13	Electronic Measurements and Instruments	3	0	0	20	20	40	60	100	3
2	EC15	Computer Architecture	3	0	0	20	20	40	60	100	3
3	EC16	Probability Theory and Stochastic Processes	3	0	0	20	20	40	60	100	3
4	EC17	Digital Signal Processing	3	0	0	20	20	40	60	100	3
5	ECEL*	Program Elective – 1	3	0	0	20	20	40	60	100	3
6	HSMC 501	Management-I (Organizational Behavior)	3	0	0	20	20	40	60	100	3
7		Online courses, NPTEL for Honors degree									
PRACTICALS											
1	EC14	Electronic Measurements & Instrument s Lab	0	0	2	0	0	40	60	100	1
2	EC18	Digital Signal Processing Lab	0	0	2	0	0	40	60	100	1
Total											**20**

SIXTH SEMESTER

S. No	Course Code	Subject	Period			Evaluation Scheme					Total Credits
						Sessional Exam			End Exams	Subject Total	
			L	T	P	CA	TA	Total			
THEORY											
1	EC19	Control Systems	3	0	0	20	20	40	60	100	3
2	EC20	Computer Network	3	0	0	20	20	40	60	100	3
3	ECEL*	Program Elective – 2	3	0	0	20	20	40	60	100	3
4	ECEL*	Program Elective – 3	3	0	0	20	20	40	60	100	3
5		Open Elective-1	3	0	0	20	20	40	60	100	3
6	MC02	Constitution of India	3	0	0	20	20	40	60	100	0
7		Online courses, NPTEL for Honors degree									
PRACTICALS											
1	EC21	Computer Networks Lab	0	0	4	-	-	40	60	100	2
2	EC22	Control Systems Lab	0	0	2	-	-	40	60	100	1
2	EC23	Mini Project/Electronic Design workshop	0	0	4	-	-	40	60	100	2
Total											**20**

Program Elective Courses:

S.N	Course Code	Course Title	Preferred Semester
1	ECEL1	Bio-Medical Electronics	V
2	ECEL2	CMOS Design	V
3	ECEL3	Information Theory and Coding	V
4	ECEL4	Introduction to MEMS	VI
5	ECEL5	Electro Magnetic Waves	VI
6	ECEL6	Speech and Audio Processing	VI
7	ECEL7	Power Electronics	VI
8	ECEL8	Nano electronics	VI
9	ECEL9	Scientific computing	VI
10	ECEL10	Adaptive Signal Processing	VII
11	ECEL11	Antennas and Propagation	VII
12	ECEL12	Digital Image & Video Processing	VII
13	ECEL13	Mobile Communication and Networks	VII
14	ECEL14	Mixed Signal Design	VII
15	ECEL15	Microwave Theory and Techniques	VII
16	ECEL16	Fiber Optic Communications	VII
17	ECEL 17	RADAR and Satellite Communication	VII
18	ECEL18	High Speed Electronics	VII
19	ECEL19	Wavelets	VII
20	ECEL20	Wireless Sensor Networks	VIII
21	ECEL21	Embedded systems	VIII
22	ECEL22	Error correcting codes	VIII

OPEN ELECTIVES

1. Non-Conventional Energy Resources(7^{th})
2. Quality Management (6^{th})
3. Operations Research
4. Introduction to Biotechnology
5. Nonlinear Dynamic Systems
6. Product Development
7. Automation & Robotics
8. Soft Computing (Neural Networks, Fuzzy Logic and Genetic Algorithm)
9. Nano Sciences
10. Laser Systems and Applications
11. Space Sciences
12. Polymer Science & Technology
13. Nuclear Science
14. Material Science
15. Finance & Accounting
16. Human Resource Development (7^{th})
17. Cyber Law & Ethics (8^{th})
18. Introduction to Philosophical Thoughts
19. Comparative Study of Literature
20. Indian Music System
21. History of Science & Engineering
22. Introduction to Art and Aesthetics
23. Economic Policies in India
24. Entrepreneurship Development(8^{th})

DETAILED CURRICULUM CONTENTS

Undergraduate Degree

In

Engineering & Technology

BRANCH: Electronics & Communication Engineering

SEMESTER -5

Course Code: EC13 **Course Name:** Electronic Measurement & Instruments
Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- To understand operation of different instruments.
- To describe different terminology related to measurements.
- To understand the principles of various types of transducers and sensors.

Course Description:

Electronic measuring instruments are widely used for measuring the electrical charge quantity and amount of flow of electricity through different electronic appliances The course deals with topics such as Principle of measurements, Errors, Accuracy, Units of measurements and electrical standards, , introduction to the design of electronic equipment‘s for temperature, pressure, level, flow measurement, speed etc.

Course Contents:

Unit 1

Unit, dimensions and standards: Scientific notations and metric prefixes. SI electrical units, SI temperature scales, other unit systems, dimension and standards. Measurement Errors: Gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, Measurement error combination, basics of statistical analysis. PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohmmeter.

Unit 2

Transistor voltmeter circuits, AC electronic voltmeter, current measurement with electronic instruments, probes Digital voltmeter systems, digital multimeters, digital frequency meter system.

Unit 3

Voltmeter and ammeter methods, Wheatstone bridge, low resistance measurements, low resistance measuring instruments AC bridge theory, capacitance bridges, Inductance bridges, Q meter.

Unit 4 CRO: CRT, wave form display, time base, dual trace oscilloscope, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Oscilloscope specifications and performance. Delay time based Oscilloscopes, Sampling Oscilloscope, DSO, DSO applications.

Unit 5

Instrument calibration: Comparison method, digital multimeters as standard instrument, calibration instrument Recorders: X-Y recorders, plotters.

Course Learning Outcomes (CLOs):

- Employ appropriate instruments to measure given sets of parameters.
- Practice the construction of testing and measuring set up for electronic systems.
- To have a deep understanding about instrumentation concepts this can be applied to Control systems.

Text books:

- David A. Bel, ―Electronic Instrumentation and Measurements‖, 2nd Ed., PHI, New Delhi 2008.
- Oliver and Cage, ―Electronic Measurements and Instrumentation‖, TMH, 2009.

Reference books:

- Alan S. Moris, ‒Measurement and Instrumentation Principles‖, Elsevier (Buterworth Heinman), 2008.

Online links for study & reference materials:

https://nptel.ac.in/courses/108/105/108105153/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Mid exam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: EC15 **Course Name: Computer Architecture**
Course Credit Hour: 3hr **Total Contact Hour:** 42hr

Course Objective:

- How Computer Systems work & the basic principles
- Instruction Level Architecture and Instruction Execution
- The current state of art in memory system design
- How I/O devices are accessed and its principles.
- To provide the knowledge on Instruction Level Parallelism
- To impart the knowledge on microprogramming
- Concepts of advanced pipelining techniques.

Course Description:

- This course provides students with a solid understanding of fundamental architectural techniques used to build today's high-performance processors and systems.
- Course topics include pipelining, superscalar, out of order execution, multithreading, caches, virtual memory, and multiprocessors.

Course Contents:

Module 1: Introduction to computer organization (6 hours)
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.

Module 2: Memory organization (6 hours)
System memory, Cache memory - types and organization, Virtual memory and its implementation, Memory management unit, Magnetic Hard disks, Optical Disks.

Module 3: Input – output Organization (8 hours)
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.

Module 4: 16 and 32 microprocessors (8 hours)
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

Module 5: Pipelining(8 hours)
Introduction to pipelining, Instruction level pipelining (ILP), compiler techniques for ILP, Data hazards, Dynamic scheduling, Dependability, Branch cost, Branch Prediction, Influence on instruction set.

Module 6: Different Architectures (8 hours)
VLIW Architecture, DSP Architecture, SoC architecture, MIPS Processor and programming

Course learning outcomes:
Understand the concepts of microprocessors, their principles and practices.

- Write efficient programs in assembly language of the 8086 family of microprocessors.

- Organize a modern computer system and be able to relate it to real examples.
- Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.
- Implement embedded applications using ATOM processor.

Text Books:

- ―Computer Architecture and Organization‖, 3rd Edition by John P. Hayes, WCB/McGraw-Hill

Reference Books:

- ―Computer Organization and Architecture: Designing for Performance‖, 10th Edition by William Stallings, Pearson Education.
- ―Computer System Design and Architecture‖, 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Online links for study & reference materials:

NPTEL

Assessment method :(Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: EC16 **Course Name: Probability Theory and Stochastic Processes**
Course Credit Hour: 3hr **Total Contact Hour:** 30hrs

Course Objective:

The main objective of this course is to provide students uunderstand representation of random signals and application in different areas, analysis characteristics of any random processes, make use of theorems related to random signals and understand propagation of random signals in LTI systems.

Course Description:

This course provides an introduction to Probability and Stochastic Processes with applications. Topics include: basic probability, conditional probability, random variables, probability distributions, Markov, Chebyshev and Chernoff bounds , Random sequences and modes of convergence, Transmission of random process.

Course Contents:

Unit-1

Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models.

Unit 2

Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions.

Unit-3

Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds.

Unit-4

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem. Random process, Stationary processes, Mean and covariance functions. Ergodicity, Transmission of random process through LTI. Power spectral density.

Course Learning Outcomes (CLOs):

- CLO-1: Understand representation of random signals.
- CLO-2: Investigate characteristics of random processes
- CLO-3: Make use of theorems related to random signals
- CLO-4: To understand propagation of random signals in LTI systems.

Text books:

- H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education.
- Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes, McGraw Hill.
- P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,

- P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers.

Reference books:

- K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International.
- W. Feller, –An Introduction to Probability Theory and its Applications‖, Wiley.

Online links for study & reference materials:

https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ma19/

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1	- 04%
Assignment -2	- 04%
Assessment-3(Mid-Exam)	- 20%
Assignment-3	- 04%
Assignment-4	- 04%
Assignment-5	- 04%
Total Internal Assessment	**- 40%**

Course Code: EC17 **Course Name: Digital Signal Processing**
Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective:

- To develop a thorough understanding of the central elements of discrete time signal processing theory and the ability to apply this theory to real-world signal processing applications.
- Use z-transforms and discrete time Fourier transforms to analyze a digital system.
- Understand the discrete Fourier transform (DFT), its applications and its implementation by FFT techniques.
- Design and understand finite & infinite impulse response filters for various applications.

Course Description:

The course covers theory and methods for digital signal processing including basic principles governing the analysis and design of discrete-time systems as signal processing devices. Review of discrete-time linear, time-invariant systems, Fourier transforms and z-transforms. Topics include sampling, impulse response, frequency response, finite and infinite impulse response systems, linear phase systems, digital filter design and implementation, discrete-time Fourier transforms, discrete Fourier transform, and the fast Fourier transform algorithms.

Course Contents:

Unit 1

Discrete time signals: Sequences; representation of signals on orthogonal basis; Samplingand reconstruction of signals; Discrete systems attributes, Z-Transform, Analysis of LSI systems, frequencyAnalysis, Inverse Systems, Discrete Fourier Transform (DFT), Fast Fourier Transform Algorithm, Implementation of Discrete Time Systems

Unit 2

Designof FIR Digital filters: Windowmethod,Park-McClellan's method.Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations;Lowpass, Bandpass, Bandstop and High pass filters.

Unit 3

Effect of finite register length in FIR filter design.Parametric and non-parametric spectral estimation.

Unit 4

Introduction to multirate signalprocessing, Application of DSP.

Course Learning Outcomes(CLOs) :

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

- Represent signals mathematically in continuous and discrete time and frequency domain
- Get the response of an LSI system to different signals
- Design of different types of digital filters for various applications

Text books:

- S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
- A.S. Sedra and K.C. Smith, Microelectronic Circuits, Edition IV**.**

Reference books:

- A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.

- John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
- L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.

Online links for study & reference materials:

https://nptel.ac.in/courses/108/105/108105055/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code : ECEL1 **Course Name: Bio-Medical Electronics**
Course Credit: 4 **Total Contact Hour:** 40hr

Course Objective :

To study the working of different medical equipments

Course Description :

Bio medical electronics (**BME**) is the application of engineering principles and design concepts to medicine and biology for healthcare purposes (e.g. diagnostic or therapeutic). This field seeks to close the gap between engineering and medicine, combining the design and problem solving skills of engineering with medical and biological sciences to advance health care treatment, including diagnosis, monitoring, and therapy.

Course Contents :

Unit 1

Introduction to the physiology of cardiac, nervous & muscular and respiratory systems. Transducers and Electrodes: Different types of transducers & their selection for biomedical applications. Electrode theory, selection criteria of electrodes & different types of electrodes such as, Ag – Ag Cl, pH, etc.

Unit 2

Cardiovascular measurement: The heart & the other cardiovascular systems. Measurement of Blood pressure-direct and indirect method, Cardiac output and cardiac rate. Electrocardiography-waveform-standard lead systems typical ECG amplifier, phonocardiography, Ballisto cardiography, Cardiac pacemaker –defibrillator –different types and its selection.

Unit 3

EEG Instrumentation requirements –EEG electrode –frequency bands – recording systems EMG basic principle-block diagram of a recorder –pre amplifier. Bed side monitor –block diagram- measuring parameters-cardiac tachometer-Alarms-Lead fault indicator-central monitoring. Telemetry – modulation systems – choice of carrier frequency – single channel telemetry systems.

Unit 4

Instrumentation for clinical laboratory: Bio electric amplifiers-instrumentation amplifiers isolation amplifiers-chopper stabilized amplifiers –input guarding – Measurement of pH value of Blood-blood cell counting, blood flow, Respiratory transducers and instruments.

Mode of Evaluation: The theory and lab performance of students are evaluated separately.

Course Learning Outcomes (CLOs) :

On completion of this course, the students will be able to

- Introduce the student to the electronic devices and theory of operation in the medical area.
- Data Interpretation: Learn to design, test, and analyze electronic circuits using oscilloscopes and other electronic test equipment. Apply knowledge of engineering and science to interpret data. Develop an understanding of and develop the skills necessary to communicate findings and interpretations in an effective laboratory report.

- Electronic circuits for Biomedical Applications: Apply knowledge of engineering and science to understand the principle of biomedical electronic circuits. Understand how to apply, measure circuit performance, and solve problems in the areas of biomedical signals.
- Work in Multi-disciplinary teams: Learn to work and communicate effectively with peers on multi-disciplinary teams to attain a common goal.

Text Books

- J J Carr, –Introduction to Biomedical Equipment Technology‖ : Pearson Education 4th e/d.

Reference Books

- K S Kandpur, –Hand book of Biomedical instrumentation‖, Tata McGraw Hill 2nd e/d.
- John G Webster, –Medical Instrumentation application and design‖, John Wiley 3rd e/d.
- Richard Aston, –Principle of Biomedical Instrumentation and Measurement

Online links for study & reference materials :

https://www.slideshare.net/CHINTTANPUBLICATIONS/biomedical-electronics-by-j-f-khan-pdf

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: ECEL2 **Course Name: CMOS Design**
Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective :

The objectives of the course is to enable students to:

- Impart knowledge of MOS transistor theory and CMOS technologies.
- Impart knowledge on architectural choices and performance tradeoffs involved in designing and realizing the circuits in CMOS technology.
- Cultivate the concepts of subsystem design processes.

Course Description :

This is an introductory course which covers basic theories and techniques of digital VLSI design in CMOS technology. In this course, we will study the fundamental concepts and structures of designing digital VLSI systems include CMOS devices and circuits, standard CMOS fabrication processes, CMOS design rules, static and dynamic logic structures, interconnect analysis, CMOS chip layout, simulation

Course Contents :

Unit 1

Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS Technologies. VLSI Fabrication, Oxidation, Lithography, Diffusion, Ion Implantation, Metallization, Integrated Resistors and Capacitors.

Unit 2

MOS Theory Analysis: Basic Electrical Properties of MOS Circuits: Ids-Vds Relationships,MOS Transistor Threshold Voltage Vth, Gradual channel approximation, MOS Capacitance, Short Channel and Narrow Channel Width Effects, Scaling of CMOS Circuits.

Unit 3

Inverter characteristics:- NMOS Inverter, Various Pull-ups, CMOS Inverter Analysis and Design, Bi-CMOS Inverters, Latch up in CMOS Circuits.

Unit 4

Parasitics. Delay: RC Delay model, linear delay model, logical path efforts. Power, interconnect and Robustness in CMOS circuit layout.

Unit 5

CMOS Circuits and Logic Design Rules:, MOS Layers, Stick Diagrams, Design Rules and Layout, 2µm, 1.2 µm Design Rules, Rules for Vias and Contacts, Stick Diagrams and Simple Symbolic Encodings for NMOS, PMOS, CMOS and BiCMOS Logic Gates.

Unit 6

Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic. Sequential Circuit Design: Static circuits. Design of latches and Flip-flops. Pass Transistor, Transmission Gate

Course Learning Outcomes (CLOs) :

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

- **CO1 & CO2**: be able to use mathematical methods and circuit analysis models in analysis of CMOS , CMOS fabrication flow and technology scaling.
- **CO3**: Be able to create models of moderately sized CMOS circuits that realize specified digital functions.

- **CO4:** Estimate and optimize combinational circuit delay using RC delay models and logical effort,and optimize interconnect delay and noise
- **CO5:** be able to use the physical design aspects to draw the basic gates using the stick and layout diagrams.
- **CO6**: Be able to design static CMOS combinational and sequential logic at the transistor level, including mask layout.

Text books :

- Sung-Mo Kang & Yusuf Leblebici, CMOS Digital Integrated Circuits Analysis and Design, McGraw-Hill, 1998.
- Neil H.E.Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, Addison Wesley, 1998.
- J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.

Reference books :

- C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.
- L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985.
- K. Martin, Digital Integrated circuit design, Oxford University press, 2001.
- A.Mukherji, Introduction to nMOS and CMOS VLSI system design, Prentice Hall Inc., 1986.
- C.Mead and L.Conway, Introduction to VLSI systems, Addison Wesley, 1986.

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: ECEL3 **Course Name: Information Theory and Coding**
Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective:

- Understand the basics of information theory and coding theories.
- Introduce the concept of amount of information, entropy, channel capacity, errordetection and error-correction codes, block coding, convolution coding, and Viterbi decoding algorithm.
- Understand and explain the basic concepts of information theory, source coding, channel and channel capacity, channel coding and relation among them.
- Describe the real life applications based on the fundamental theory.

Course Description:

This course comprises of the concepts of entropy, mutual information, the Asymptotic Equipartition property, applications to source coding (data compression), applications to channel capacity (channel coding), differential entropy and its application to waveform channel capacities, and a subset of advanced topics such as Kolmogorov complexity, timing (covert) communications, or rate-distortion theory, as time permits. The second half of the course comprises Hamming codes, cyclic codes (CRC and BCH codes), a brief introduction to Reed-Solomon codes, and perhaps universal codes (Lempel-Ziv coding). Students will be encouraged to choose non-traditional applications of information theory or coding for the course research project.

Course Contents:

Unit 1

Basics of information theory, entropy for discrete ensembles; Shannon's noiseless codingtheorem; Encoding of discrete sources.Different types of optical fibers, Modal analysis of a step index fiber.

Unit 2

Markov sources; Shannon's noisy coding theorem and converse for discrete channels;Calculation of channel capacity and bounds for discrete channels; Application to continuous channels.

Unit 3

Techniques of coding and decoding; Huffman codes and uniquely detectable codes

Unit 4

Cyclic codes, convolutional arithmetic codes.

Course Learning Outcomes(CLOs) :

- Understand the concept of information and entropy
- Understand Shannon‘s theorem for coding
- Calculation of channel capacity
- Apply coding techniques

Text books:

- N. Abramson, Information and Coding, McGraw Hill, 1963.
- M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.

Reference books:

- R.B. Ash, Information Theory, Prentice Hall, 1970.
- Shu Lin and D.J. Costello Jr., Error Control Coding, Prentice Hall, 1983.

Online links for study & reference materials:

https://nptel.ac.in/courses/108/102/108102117/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: HSMC 501 **Course Name:** Organization Behavior
Course Credit Hour: 3Hr **Total Contact Hour:** 30hr

Course Objective:

- The student will acquire knowledge of organizational behavior including workplace environment, leadership skills, and organization management.
- To enhance the understanding of the dynamics of interactions between individuals and the organization. To facilitate a clear perspective to diagnose and effectively handle human behavior issues in Organization and to develop greater insight into their behavior in interpersonal and groups and team.

Course Description:

- This course introduces the fundamental of organizational behavior includes important insights about motivation, leadership, perception, and learning theories.

Course Contents:

Unit 1: Introduction of OB: (6 lectures)

The concept and nature of OB, need to understand human behavior, Its significance, and impact, Challenges, and opportunities.

Unit 2: Individual dimensions of behavior:(8 lectures)

Individual characteristics, Ability, Values, Attitudes, Formation, Organization related attitude, Relationship between attitude and behavior, Personality, Types, Determinants and traits, learning and Learning theories, Motivation and Motivation theories.

Unit 3: Group behavior and team development: (8 lectures)

Concept of groups and group dynamics, Types of groups, Formal and Informal group, Stages of group development, Group cohesiveness, Group decision making, Concept of team vs group, Types of teams, Managing teams.

Unit 4: Organizational culture and conflict management: (8 lectures)

Organizational culture, Leadership: What is leadership, types of leaders and leadership styles, traits and qualities of an effective leader, managing conflicts, resolution of conflicts, Change management.

Course Learning Outcomes (CLOs):

CLO-1: Develop the basic concept of organization and types.
CLO-2: Inculcate skills and understand behavior.

CLO-3: To understand group behavior and emotional development.
CLO-4: To understand organization culture and management.

Textbooks:

(i) Fred Luthans, ―Organizational Behavior‖, 12th Edition, McGraw Hill International Edition
(ii) Stephen P. Robbins, ―Organizational Behavior‖, 12th Edition, Prentice Hall
(iii) Aswathappa K, ―Organizational Behavior (Text, Cases, and Games)‖, Himalaya Publication

Reference books:
Udai Pareek, ―Organizational Behavior‖, Oxford University Press

Assessment method: (Continuous Internal Assessment = 40%, Final Examination = 60%)

Assignment -1	- 05%
Assignment -2	- 05%
Assessment-3(Mid-Exam)	- 20%
Assignment-3/Quiz-1	- 05%
Assignment-4	- 05%
Total Internal Assessment	**- 40%**

EC18: Digital Signal Processing Laboratory [0L:0T:2P 1 credit]

List of Experiments:

1. Generation of Basic Signals using MATLAB.
2. Generation of Basic Signals using SCILAB.
3. Basic operations on Matrices using SCILAB.
4. Perform Linear Convolution of two sequences using SCILAB.
5. To perform Linear Convolution using MATLAB.
6. To perform Circular Convolution using MATLAB.
7. Perform circular convolution of two given discrete sequences using SCILAB.
8. Evaluate DFT of given sequence using MATLAB.
9. Verify Blackman and Hamming windowing techniques sequences using SCILAB.
10. Implement IIR Butterworth analog Low Pass for a 4 KHz cut off frequency using SCILAB.
11. To verify FIR filters using MATLAB.
12. To design and implement IIR (LPF/HPF) filters.

EC22: EMI Laboratory [0L:0T:2P 1 credit]

List of Experiments:

1. Study of Cathode Ray Oscilloscope.
2. Study of displacement measurement by LVDT.
3. Force measurement by strain gauge.
4. Measurement of Capacitor using Q-meter..
5. Temperature measurement by thermistor.
6. Study of optical Transducers: Photo-diode, Photo-Transistor.
7. Design of digital to analog converter, R-2R ladder Type and analysis of its characteristics.
8. To measurement of the unknown Inductance by using Maxwell's bridge method
9. To measurement of the unknown capacitance by using Schering bridge method.
10. To measurement of the unknown Frequency by using Wein's bridge method.
11. To measurement of the unknown Inductance by using Hay's bridge method.
12. To calculate Frequency using Lissajious Pattern.
13. To study digital Multimeter.

SEMESTER -6

Course Code: EC19 **Course Name:** Control Systems
Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective :

- To understand fundamental concepts of Control systems and mathematical modelling of the system.
- To understand concept of time response and frequency response of the system.
- To understand basics of stability analysis of the system.

Course Description:

This course provides an introduction to linear systems, transfer functions, and Laplace transforms. It covers stability and feedback, and provides basic design tools for specifications of transient response. It also briefly covers frequency-domain techniques.

Course Contents:

Unit 1

Introduction to control problem- Industrial Control examples. Transfer function. System with dead-time. System response. Control hardware and their models: potentiometers, synchros, LVDT, dc and ac servomotors, tacho-generators, electro hydraulic valves, hydraulic servomotors, electro pneumatic valves, pneumatic actuators. Closed-loop systems. Block diagram and signal flow graph analysis.

Unit 2

Feedback control systems- Stability, steady-state accuracy,transient accuracy, disturbance rejection, insensitivity and robustness. proportional, integral and derivative systems. Feed-forward and multi-loop control configurations, stability concept, relative stability, Routh stability criterion.

Unit 3

Time response of second-order systems, steady-state errors and error constants. Performance specifications in time-domain. Root locus method of design. Lead and lag compensation.

Unit 4

Frequency-response analysis- Polar plots, Bode plot, stability in frequency domain, Nyquist plots. Nyquist stability criterion. Performance specifications in frequency-domain. Frequency-domain methods of design, Compensation & their realization in time & frequency domain. Lead and Lag compensation. Op-amp based and digital implementation of compensators. Tuning of process controllers. State variable formulation and solution

Unit 5

State variable Analysis- Concepts of state, state variable, state model, state modelsfor linear continuous time functions, diagonalization of transfer function, solution of state equations, concept of controllability & observability.

Introduction to Optimal control & Nonlinear control, Optimal Control problem,Regulator problem, Output regulator, treking problem. Nonlinear system – Basic concept & analysis.

Course Learning Outcomes(CLOs) :

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

- Characterize a system and find its study state behavior
- Investigate stability of a system using different tests
- Design various controllers

- Solve liner, non-liner and optimal control problems

Text books:

- Gopal. M., ―Control Systems: Principles and Design‖, Tata McGraw-Hill, 1997.
- Kuo, B.C., ―Automatic Control System‖, Prentice Hall, sixth edition, 1993.

Reference books:

- Ogata, K., ―Modern Control Engineering‖, Prentice Hall, second edition, 1991.
- Nagrath & Gopal, ―Modern Control Engineering‖, New Age International, New Delhi

Online links for study & reference materials:

https://nptel.ac.in/courses/107/106/107106081/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: EC20 **Course Name:** Computer Networks
Course Credit Hour: 3hr **Total Contact Hour:** 35hr

Course Objective:

- To develop an understanding of modern network architectures from a design and performance perspective.
- To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
- To provide an opportunity to do network programming
- To provide a WLAN measurement ideas.

Course Description:

The course covers the basic and advanced concepts and techniques of Computer Networks from both theoretical and practical perspective. The material includes Data communication Components, Data Link Layer and Medium Access Sub Layer, Network Layer, Transport Layer and Application Layer. The students will be able to understand almost all algorithms required to understand real world network issues.

Course Contents:

Unit-1

Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Unit-2

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA.

Unit-3

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routingprotocols.

Unit-4

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Unit-5:

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

Course Learning Outcomes (CLOs):

- **CLO-1**: Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
- **CLO-2:** For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component.
- **CLO-3**: For a given problem related TCP/IP protocol developed the network

programming.

- **CLO-4**: Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

Text books:

- BehrouzA. Frozen, Data Communication and Networking, 4th Edition, McGraw- Hill.
- William Stallings, Data and Computer Communication, 8th Edition, , Pearson Prentice Hall India.

Reference books:

- Andrew S. Tanenbaum , Computer Networks, 8th Edition, , Pearson New International Edition.
- Douglas Comer , Internetworking with TCP/IP, Volume 1, 6th Edition , Prentice Hall of India.
- Richard Stevens , TCP/IP Illustrated, Addison-Wesley, United States o f America.

Online links for study & reference materials:

https://nptel.ac.in/courses/106/105/106105183/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assignment-1	- 05%
Assignment-2	- 05%
Assessment-3(Mid-Term Exam)	- 20%
Assignment-3	- 05%
Assignment-1/Quiz	- 05%
Total Internal Assessment	**- 40%**

Course Code : ECEL04 **Course Name : Introduction to MEMS**
Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective : The goal of this course is to introduce students to MEMS devices, microsystems and their applications as follows

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

Course Description : Micro-electro-mechanical is one of the emerging fields.. The course will start with an introduction on the mechanical and electrical properties of materials commonly used in MEMS. The micro-fabrication processes, including bulk and surface micromachining processes for realization of these micro/nano transducers will be discussed, along with integration of MEMS with CMOS electronics. Some representative sensors and actuators, including capacitive & piezoelectric pressure sensors, mechanical resonators and filters, minimally invasive implantable medical devices, and biomedical lab-on-a-chip will be used to illustrate the capabilities & advantages of these miniaturized devices. This course designs for the give the knowledge of the fabrication of different micro electronics system. It covers the different topic related with the micro system, fabrication technology at micro level.

Course Contents :

Unit1

INTRODUCTION Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

Unit2

SENSORS AND ACTUATORS-I Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph - Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

Unit3

SENSORS AND ACTUATORS-II Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

Uint4

MICROMACHINING Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies –Basic surface micro machining processes –

Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.

Unit 5

POLYMER AND OPTICAL MEMS Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

Text Books:

- Chang Liu, _Foundations of MEMS', Pearson Education Inc., 2012.
- Stephen D Senturia, _Microsystem Design', Springer Publication, 2000.
- Tai Ran Hsu, –MEMS & Micro systems Design and Manufacture‖ Tata McGraw Hill, New Delhi, 2002.

References Books:

- Nadim Maluf,— An Introduction to Micro Electro Mechanical System Design‖, Artech House, 2000.
- Mohamed Gad-el-Hak, editor, ― The MEMS Handbook‖, CRC press Baco Raton, 2001.
- Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
- James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
- Thomas M.Adams and Richard A.Layton, –Introduction MEMS, Fabrication and Application,‖ Springer, 2010.

Course Learning Outcomes(CLOs) :

- **CLO1** : Ability to understand the operation of micro devices, micro systems and their applications.
- **CLO2 &CLO3** : able to understand the concept of sensors and actuators, their uses& application
- **CLO4** : Ability to design the micro devices, micro systems using the MEMS fabrication process
- **CO5:-Able to understand about the** polymer and optical mems

Online links for study & reference materials :

https://nptel.ac.in/courses/117/105/117105082/

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: ECEL5 **Course Name:** Electromagnetic Waves
Course Credit:3 **Total Contact Hour:** 40hr

Course Objective:

- To introduce students with different coordinate systems.
- To familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems.
- To expose the students to the ideas of electromagnetic waves and structure of transmission line.

Course Description:

This course includes the knowledge of Basic Laws, Concepts and proofs related to Electrostatic Fields and Magneto static Fields. It distinguishes between the static and time-varying fields establish the corresponding sets of Maxwell‘s Equations and Boundary Conditions. It analyzes the Wave Equations for good conductors, good dielectrics and evaluate the UPW Characteristics for several practical media of interest.

Course Contents:

Unit 1

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmitssion line sections as circuit elements.

Unit 2

Maxwell‘s Equations- Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface.

Unit 3

Uniform Plane Wave- Uniform plane wave, Propagation of wave, Wave polarization, Poincare‘s Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor.

Unit 4

Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

Unit 5

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

Unit 6

Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna.

Course Learning Outcomes (CLOs):

- Understand characteristics and wave propagation on high frequency transmission lines.
- Use sections of transmission line sections for realizing circuit elements.
- Characterize uniform plane wave.

- Calculate reflection and transmission of waves at media interface
- Understand principle of radiation and radiation characteristics of an antenna

Text books:

- E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
- Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.

Reference books:

- R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005

Online links for study & reference materials:

https://nptel.ac.in/courses/117/101/117101056/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Mid exam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: ECEL06 **Course Name: Speech and Audio Processing**
Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective:

- To introduce the models of speech and audio production and acoustic phonetics
- To teach time and frequency domain techniques for estimating speech parameters
- To teach predictive techniques for speech coding
- To introduce speech recognition and speech synthesis applications

Course Description:

This course covers the basic principles of digital speech processing, fundamentals of speech production and perception with basic techniques for digital speech processing: like short – time energy, magnitude, autocorrelation ,short – time Fourier analysis ,homomorphic (convolutional) methods, linear predictive methods – Speech estimation methods ,speech/non-speech detection , voiced/unvoiced/non-speech segmentation/classification , Applications of speech signal processing , Speech coding , Speech synthesis, Speech recognition/natural language processing

Course Contents:

Unit 1

Introduction- Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness. Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters,convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Unit 2

Linear Prediction of Speech- Basic concepts of linear prediction; LinearPrediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

Unit 3

Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

Linear Prediction Coding- LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations of the LPC model.

Unit 4

Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero- state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

Unit 5

Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

Course Learning Outcomes(CLOs) :

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

- Mathematically model the speech signal
- Analyze the quality and properties of speech signal.
- Modify and enhance the speech and audio signals.

Text books:

- –Digital Speech‖ by A.M.Kondoz, Second Edition (Wiley Students‟ Edition), 2004.

Reference books:

- –Speech Coding Algorithms: Foundation and Evolution of Standardized Coders‖, W.C. Chu, WileyInter science, 2003.

Online links for study & reference materials:

https://nptel.ac.in/courses/117/105/117105145/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: ECEL07 **Course Name:** Power Electronics
Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective:

- To understand and acquire knowledge about various power semiconductor devices.
- To prepare the students to analyze and design different power converter circuits.

Course Description:

The course focuses on presenting concepts for conversion, control and monitoring of electric energy using power semiconductor devices.Methods for analyzing power electronic converters suitable for AC/DC, DC/DC and DC/AC electrical energy conversions including resonance converters are presented. Additionally, principles for designing power electronic converters, including their power semiconductors and passive elements are established. Computer-aided analysis and simulations of the electrical and thermal performance of power electronic converters is also among the course objectives.

Course Contents:

Unit 1

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

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- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

Unit 3

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

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, Single phase current source inverter

Unit 5

Switching Power Supplies: Analysis of fly back, forward converters for SMPS, Resonant converters-need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter.

Applications: Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS. Separately excited DC motor drive. P M Stepper motor Drive.

Course Learning Outcomes(CLOs) :

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

- Build and test circuits using power devices such as SCR
- Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
- Learn how to analyze these inverters and some basic applications.

Text books:

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

Reference books:

- P.C. Sen., –Modern Power Electronics‖, edition II, 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.

Online links for study & reference materials:

https://nptel.ac.in/courses/108/102/108102145/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code : ECEL8 **Course Name :** Nano electronics

Course Credit: 3 **Total Contact Hour:** 40hr

Course Objective :

Students undergoing this course are exposed to:

- Know the types of nanotechnology, atomic structure, molecular technology and preparation of nano materials.
- Understand the fundamentals of nano electronics and its properties.
- Know the Silicon MOSFET‘s, QTD and carbon nano tubes.
- Understand the fundamentals of molecular electronics.

Course Description :

The major goals and objectives are to provide graduate students with knowledge and understanding of physical background and applications of nanoelectronics. The course will cover electrical and optical properties of materials and nanostructures, fabrication of nanostructures, nanoelectronic devices including resonant-tunneling devices, transistors, and single-electron transfer devices, as well as applications of nanotechnologies in molecular biology and medicine.

Course Contents :

Unit 1

Introduction To Nanotechnology:- Introduction: Discussion of the International Technology Roadmap characteristics: Need for new concepts in electronics From microelectronics towards biomolecule electronics 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 Tunneling Microscope. Nanomaterials: Preparation –Plasma Arcing – Chemical Vapor Deposition – Sol-Gels – Electrode Position – Ball Milling –Applications Of Nanomaterials.

Unit 2

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

Silicon MOSFET & Quantum Transport Devices:-Silicon MOSFETS - Novel materials and alternate concepts:- fundamentals of MOSFET Devices- scaling rules – silicon-dioxide based gate dielectrics – metal gates – junctions & contacts – advanced MOSFET concepts. Quantum transport devices based on resonant tunneling: Electron tunneling – resonant tunneling diodes – resonant tunneling devices; Single electron devices for logic applicationssingle electron devices – applications of single electron devices to logic circuits.

Unit 4

Carbon Nanotubes:-Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes – assemblies – purification of carbon nanotubes – electronic properties – synthesis of carbon nanotubes – carbon nanotube interconnects – carbon nanotube fets – Nanotube for memory applications – prospects of all carbon nanotube nanoelectronics.

Unit 5

Molecular Electronics:-Electrodes & contacts – functions – molecular electronic devices – first test systems – simulation and circuit design – fabrication; Future applications: MEMS – robots – random access memory – mass storage devices

Course Learning Outcomes(CLOs) :

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

- CLO1: Discuss the types of nanotechnology, molecular technology and the preparation of nano materials.
- CLO2: Explains the fundamental of the devices such as logic devices, field effect devices, and spintronics
- CLO3: Describe the concepts of silicon MOSFET and Quantum Transport Devices.
- CLO4: Summarize the types, synthesis, interconnects and applications of carbon nano tubes.
- CLO 5: Explain the concepts, functions, fabrications and applications of molecular electronics.

Text books :

- Michael Wilson, KamaliKannangara, Geoff Smith, Michelle Simmons and Burkhard 2. Raguse, Nanotechnology: Basic Science and Emerging Technologies, Chapman & Hall / CRC, 2002.
- Rainer Waser (Ed.), Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, Wiley-VCH, 2003.
- T. Pradeep, NANO: The Essentials – Understanding Nanoscience and Nanotechnology, TMH, 2007.

Reference books :

- M.Ziese and M.J Thornton(Eds.)‖Spin Electronics ―, Springer-verlag 2001.
- M.Dutta and M.A Stroscio Edited by ―Quantum Based Electronic Devices and systems‖, world Scientific, 2000.
- K.E. Drexler, Nanosystems, Wiley, 1992.
- J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
- C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

Online links for study & reference materials :

https://www.edx.org/course/fundamentals-nanoelectronics-part-b-purduex-nano521x

Assessment method : (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Midexam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Course Code: ECEL9 **Course Name:** Scientific Computing
Course Credit Hour: 3hr **Total Contact Hour:** 40hr

Course Objective:

- To make students familiar with the concepts of programming and the get they accustomed with high-level languages like MATLAB etc.
- To provide an overview of some of the issues and problems that arise in scientific computation, such as (non-)linear systems, numerical and symbolic integration, differential equations and simulation.

Course Description:

After this course the student should be able to understand simple mathematical models and scientific problems (such as finite capacity growth models, plotting a line through data points, etc.) and implement a solution in an adequate scientific programming language (such as MATLAB).

Course Contents:

UNIT-1

Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation

UNIT-2

System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting

UNIT-3

Eigen-values and singular values: Eigen-values and Eigenvectors, Methods for Computing All Eigen-values, Jacobi Method, Methods for Computing Selected Eigen-values, Singular Values Decomposition, Application of SVD

UNIT-4

Nonlinear equations: Fixed Point Iteration, Newton‘s Method, Inverse Interpolation
Method Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation

UNIT-5

Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences.

Course Learning Outcomes (CLOs):

- Exploring the properties for numerical methods and mathematical models by using the analysis methods covered in the course.

- Understanding the results when running a MATLAB program, and describe a problem with an algorithm or a programming code in MATLAB (which might include self-written MATLAB functions);
- Structure and divide a computational problem into sub-problems, formulate an algorithm and implement the algorithm in MATLAB;

Text books:

- Heath Michael T., ‒Scientific Computing: An Introductory Survey‖ , McGraw-Hill, 2nd Ed., 2002
- Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, ‒Numerical Recipes: The Art of Scientific Computing‖, Cambridge University Press, 3rd Ed., 2007

Reference books :

- Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, ‒Scientific Computing With MATLAB And Octave‖, Springer, 3rd Ed., 2010

Online links for study & reference materials :

https://nptel.ac.in/courses/111/102/111102137/

Assessment method: (Continuous Internal Assessment = 40% , Final Examination = 60%)

Assessment -1	- 05%
Assessment-2	- 05%
Assessment-3(Mid exam)	- 20%
Assessment-3	- 05%
Assessment-4	- 05%
Total Internal Assessment	**- 40%**

Open Elective 1 for 6th Sem

EC21: Computer Networks Laboratory [0L:0T:4P 2 credit]
Hands-on experiments related to the course contents EC20

EC22: Control System Laboratory [0L:0T:4P 2 credit]
Hands-on experiments related to the course contents EC19

Course Code : EC23 **Course Name :** Mini Project/Electronic Design Workshop
Course Credit: 2 **Total Contact Hour:** 20hr

Guidelines:

2. 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.

3. 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.

4. Mini Project should cater to a small system required in laboratory or real life.

5. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.

6. 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.

7. 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.

8. The student is expected to exert on design, development and testing of the proposed work as per the schedule.

9. 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.

10. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.

11. 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:

- Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.

- Design, implement and test the prototype/algorithm in order to solve the conceived problem.

- Write comprehensive report on mini project work.