Course Description

Title: Advanced Communication System **Code:**

L-T-P scheme: 3-0-0 **Credits: 3**

Prerequisite: Students must have already studied courses, "Analog and Digital communication and "signals and systems".

Objective:

1. Develop problem solving ability using Communication Systems; develop ability to express solutions to problems clearly and precisely.
2. Develop ability to design and analyze probability of errors. Develop fundamental and conceptual learning on basic and advanced Digital communication systems.

Learning Outcomes:

The students shall acquire the generic skills to study & design various applications of the systems and solve the problems.

Course Outcome	Description
CO1	Baseband Modulation techniques Source Coding: Formatting data, Noise effect
CO2	Study and characteristics of Bandpass Modulation Techniques
CO3	Probability of error analysis of baseband and bandpass modulation techniques
CO4	Signal analysis techniques and their response in Signal space
CO5	Design and analysis on Error detecting and correcting scheme
CO6	Study on advanced multi carrier communication systems

Course Contents:

Unit-1: Introduction: Elements of a communication system, Different types of signals, PSD, Random process, Ergodicity, Noise.

Unit-2: Source Coding: Formatting data, Quantization, Dithering, Source coding, Baseband modulation & Correlative coding: Pulse modulation, Correlative coding, PCM generation and detection, quantization, quantization error, non uniform quantization, companding, differential PCM, Delta modulation, Adaptive delta modulation.

Unit-3: Analog Communication systems (A.M.): Different types of AM & FM systems, Transmitters, Receivers and Antenna systems, Phase Locked Loop: Theory and applications, Capture range, Lock range, order of Low pass filter, Loop dynamics.

Unit-4: Probability of error analysis – Optimum filter, Matched filter. Coherent & Non-Coherent Reception. Probability of error for FSK, PSK, DPSK, M-ary PSK, Minimum Shift Keying (MSK). Introduction to bit Vs symbol error probability & Bandwidth. Communication Link Analysis: Link Budget Analysis, Sources of signal loss & noise, Path loss, Link margin, System trade-off, Base band modulation

& demodulation/detection

Unit-5: Base band modulation, Demodulation, Detection of binary signal in Gaussian noise, Band pass modulation & demodulation: Line codes. Binary & M-ary modulation techniques: FSK, PSK, DPSK, M-ary PSK, Minimum Phase Shift Keying (MSK) and Quadrature Amplitude Modulation. Coherent detection, non coherent detection, error performance for M- ray systems.

Unit-6: Signal Space Analysis: Signal Space, Signals and Vectors, The Gram Schmidt Procedure, optimum Signal Detection, Correlator. Multicarrier Modulation: Multicarrier modulation with overlapping sub channels, OFDM, Challenges in Multicarrier system, Spread Spectrum Communication: DSSS, Cellular system, FHSS, CDMA, Wireless sensor networks, Cognitive Radio, Wavelets and their applications.

Teaching Methodology:

1. Lectures would be interactive and it would cover the core concepts that are explained in the text and reference materials with adequate examples.
2. Tutorials will have conceptual and numerical questions that would aid in strengthening the data structures principles.

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15	Based on Unit-1 & Unit-2
Test-2	25	Based on Unit-2, Unit-3 & Unit-4 and around 30% from coverage of Test-1
Test-3	35	Based on Unit-4, Unit-5 to Unit-6 and around 30% from coverage of Test-2
Assignment	10	Based on Unit-1, Unit-2, Unit-3, Unit-4 , Unit-5 & Unit-6
Tutorials	5	Based on Unit-1, Unit-2, Unit-3, Unit-4 , Unit-5 & Unit-6
Quiz	5	Based on Unit-1, Unit-2, Unit-3, Unit-4 , Unit-5 & Unit-6
Attendance	5	Based on attendance in the theory classes
Total	100	

Text Books:

[1] Modern Digital and Analog Communications Systems - B P Lathi Third Edition Oxford university press.

[2] Communication Systems , S Haykins, John Wiley and Sons

[3] Principles of communication, Taub & Schilling Latest Edition Tata Mc Graw Hill Publication

Reference Books:

[1] Communication Systems by A B Carlson, Tata Mc Graw Hill, 2000

Web References:

[1] www.w3.com
[2] https://www.tutorialspoint.com/e_commerce/index.htm

Journals References:

[1] ACM Transactions on the communication
[2] ACM Transactions on the Information and communication Systems

Title: VLSI Circuit and System Design **Code:**

L-T-P Scheme: 3-0-0 **Credits: 3**

Prerequisite: Students must have already Knowledge of VLSI, CMOS process flow, Combinational MOS logic circuits and HDL based design.

Objective:

1. To learn and be able to implement the concept of MOS transistor and CMOS process flow.

Learning Outcomes:

Course Outcome	Description
CO1	Get familiar with overview of VLSI design complexities and simulation.
CO2	Have a good grounding of VLSI Application and terminologies, VLSI tools and MOS theory.
CO3	Basic step for design of n-well and P-well CMOS
CO4	Having an understanding of the characteristics of CMOS circuit
CO5	Be able to design static CMOS combinational and sequential logic at the transistor level, including mask layout
CO6	Work as a team on a VLSI project using HDL Language

Course Contents:

Unit-1: Building blocks of VLSI: Overview of VLSI, Complexities and Design, VLSI Simulation Steps and Tools.

Unit-2: MOS Transistor Theory: A review of MOS structure and operation, MOS I-V characteristics, MOSFET model for Circuit Simulation, Scaling and Small Geometry effects.

Unit-3: CMOS Process Flow: Basic steps, CMOS n-well process, Twin-Tub process, layout design rules.

Unit-4: MOS Inverter: Static and Dynamic Characteristic, Performance Estimation.

Unit-5: Combinational MOS logic circuits: Transmission gate, Dynamic logic, Timing issues in CMOS Digital Circuits, Semiconductor Memories, SRAM, DRAM, ROM analysis and design.

Unit-6: HDL based design: Language Fundamentals, Behavioral and RTL style of modeling, Data Flow style of description, Structural style, Test-Bench, Hazards and Fault Analysis.

Teaching Methodology:

This course is introduced to help students' 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 and testing, low power techniques, design tools and methodologies, VLSI architecture. The course is designed to give the student an understanding of the different design steps required to carry out a

complete digital VLSI (Very-Large-Scale Integration) design in silicon.

Evaluation Scheme:

Exams	**Marks**	**Coverage**
Test-1	15 Marks	Based on Unit-1, Unit-2
Test-2	25 Marks	Based on Unit-3 & Unit-4 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-5 to Unit-6 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:
Tutorials and lecture slides on VLSI Circuit and System Design Course (will be added from time to time): Digital copy will be available on the JUET server.

Text Books:
1. S. M. Kang, Y. Leblebici, CMOS Digital Integrated Circuits: Analysis and Design,3rd Edition Tata McGraw-Hill Publication, 2003.
2. J. M. Rabaey, A. Chandrakasan, B.Nikolic, Digital Integrated Circuit: A designperspective, 2nd Edition Pearson Education, 2005.

ReferenceBooks:

1. S. Sjoholm, L. Lindh, VHDL for Designers, Pearson Education Ltd., England, 1997.
2. N. Weste, David Harris, CMOS VLSI Design: A Circuits and Systems Perspective, 3rdEdition Addison Wesley, 2004.

Web References:
[1] https://www3.nd.edu/~kogge/courses/cse40462-VLSI-fa18/www/links.html
[2] https://www.tutorialspoint.com/vlsi_design/index.htm

Journals References:
[1] IEEE Transactions on Very Large Scale Integration
[2] Integration, the VLSI Journal
[3] International Journal of VLSI Design & Communication Systems

Title: ECE Design and Simulation Lab **Code:**

L-T-P scheme: 0-0-4 **Credit: 2**

Prerequisite: None

Objective:

1. To learn the fundamental & simulation of analog and digital circuits.
2. To develop an ability of designing analog and digital circuits as per the specified requirements.

Learning Outcomes:

Course Outcome	Description
CO1	Outline based on introduction to various analog and digital elements with their representation.
CO2	Describe operation and characteristics of semiconductor elements such as BJT, FET, MOSFET, etc.
CO3	Develop an ability to simulate the behavior of analog and digital circuit components.
CO4	Identify the application of operational amplifier and multi-vibrator circuit.
CO5	Apply the design techniques to implement active filter and oscillator circuits.
CO6	Demonstrate the operation of digital circuits.

List of Experiments: -

Unit 1: Lab exercise based on characteristics of semiconductor elements such as PN junction diode, Zener diode, NPN transistor, etc.

Unit 2: Lab exercise based on transfer characteristics, DC biasing, and frequency response of JFET.

Unit 3: Lab exercise based on implementation of transistor based amplifier circuits and analysis of their frequency response.

Unit 4: Lab exercise based on simulation of operational amplifier (OP-AMP) and implementation of OP-AMP based filter and oscillator circuits.

Unit 5: Lab exercise based on design and simulation of multi-vibrator and amplitude modulation

Unit 6: Lab exercise based on implementation of digital logic circuits (NOT, AND, OR, NAND, NOR, XOR, XNOR) and simulation of various combinational circuits.

Teaching Methodology:

This course is introduced to help the students to design various analog and digital circuits. In this course, the mixed technique of interactive discussion, regular assignments will be used. In the discussion the fundamental theoretical concepts will be introduced and demonstrated through examples. Discussion will be implemented in laboratory by using Circuit-Maker.

Evaluation Scheme:

Exams	Marks		Coverage
P-1	**15 Marks**		**Based on Lab Exercises: 1-7**
P-2	**15 Marks**		**Based on Lab Exercises: 8-14**
Day-to-Day Work	Viva	20 Marks	**70 Marks**
	Demonstration	20 Marks	
	Lab Record	15 Marks	
	Attendance & Discipline	15 Marks	
Total		**100 Marks**	

Learning Resources:
Study material of ECE Design and Simulation Lab-I (will be added time to time): Digital copy will be available on the JUET server.

Text Book:

[1] J. Milliman and C. C. Halkias: Integrated Electronics, Mc Graw Hill
[2] Bolleystead, Electronic Devices and Circuits
[3] Ramakant A.Gayakwad: Op-Amps and Linear Integrated Circuits, P.H.I.
[4] D.S. Chauhan & D.C. Kulshreshtha, 'Electronics Engineering', New Age, 2e, 2009.
[5] D.C. Kulshreshtha, 'Electronic Devices and Circuits', New Age, 2e, 2006.
[6] M. Morris Mano, "Digital Design," Pearson Education, 3rd edition.
[7] Taub and Schilling, Digital Integrated Electronics, McGraw Hill, Int. Ed.

Reference Books:

1. R.C. Bhatia- Business Communication (Ane Books Pvt. Ltd.)
2. P.D. Chaturvedi – Business Communication (Pearson Education, 1st Edition 2006).
3. Lesikar RV & Pettit Jr. JD – Basic Business Communication: Theory & Application (Tata Mc Graw Hill, 10thEdition)
4. Wren & Martin, High School English Grammar & Composition – S. Chand & Co. Delhi.
5. Raman Meenakshi & Sharma Sangeeta, Technical Communication-Principles & Practice –O.U.P. New Delhi. 2007.
6. Mitra Barum K., Effective Technical Communication – O.U.P. New Delhi. 2006.
7. Better Your English- a Workbook for 1st year Students- Macmillan India, New Delhi.
8. Raymond Murphy,' Essential English Grammar', Cambridge University Press.

Web References

[1] https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-101-introductory-analog-electronics-laboratory-spring-2007/study-materials/
[2] https://nptel.ac.in/courses/117/106/117106086/

Journal References

[1] Analog Integrated Circuits and Signal Processing International Journal, Springer
[2] Digital logic circuits, IEEE publisher

Title: Advanced Digital Signal Processing **Code:**

L-T-P Scheme: 3-0-0 **Credit: 3**

Prerequisite: Students must have already studied courses, "*Digital signal processing"* and *Signals and Systems*".

Objective:

1. To develop to understand the concept of digital signal processing and designing of filters.

Learning outcomes:

1. At the end of the course the students will have knowledge of digital signal processing, multirate signal processing and spectral analysis.

Course Outcome	Description
CO1	Review of Digital Signal Processing
CO2	Transforms and their applications in signal processing, Design and implementation of FIR and IIR Filter Design.
CO3	Digital Filter Design
CO4	Concept and Applications of Multi-rate Digital Signal Processing
CO5	Design and development of Adaptive Filters
CO6	Spectral Analysis and Power Spectrum Estimation

Course Contents:

Unit-1: Review of Digital Signal Processing: Review of discrete–time sequences and systems, Linear Shift Invariant (LSI) systems. Causality and Stability Criterion, FIR & IIR representations, Z-Transform, Digital structures, Fast Fourier Transform, Discrete Fourier Transform (DFT), Fast Fourier Transform (FFT) algorithms using decimation in time and decimation in frequency techniques, Chirp Z- Transform, Hilbert Transform and applications.

Unit -2: Digital Filter design: FIR filters design. IIR filter design from analog filters, digital filter design based on least square method.

Unit-3:Multirate Digital Signal Processing: Decimation & Interpolation, Sampling rate conversion, Filter design and implementation for sampling rate conversion, applications of multi-rate signal processing.

Unit-4: Adaptive Filters: Introduction. Application of adaptive filters, Adaptive Direct-form FIR filters Adaptive Lattice-Ladder filters.

Unit-5: Spectral Analysis and Power Spectrum Estimation: Spectral Analysis of Sinusoidal Signals, Spectral Analysis of Non stationary signals, Nonparametric and parametric methods of power spectrum estimation, Eigen analysis algorithms for spectral estimation.

Teaching Methodology:

1. Lectures would be interactive and it would cover the core concepts that are explained in the text and reference materials with adequate examples.

2. Practice sheets will have conceptual and numerical questions that would aid in strengthening the numerical ability of students.

Evaluation Scheme:

Exams	Marks	Coverage
Test-1	15	Based on Unit-1 & Unit-2
Test-2	25	Based on Unit-3 & Unit-4 and around 30% from coverage of Test-1
Test-3	35	Based on Unit-3, Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10	Based on Unit-1, Unit-2, Unit-3, Unit-4 & Unit-5
Tutorials	5	Based on Unit-1, Unit-2, Unit-3, Unit-4 & Unit-5
Quiz	5	Based on Unit-1, Unit-2, Unit-3, Unit-4 & Unit-5
Attendance	5	Based on attendance in the theory classes
Total	100	

Text Books:

[1] J. G. Proakis & D.G. Manolakis, "Digital Signal Processing, Principles, Algorithms and Applications", PHI.
[2] John G. Proakis, Charles M. Rader, Fuyun Ling, Chrysostomos L. Nikias, Mark Moonen and Ian K. Proudler, Algorithms for Statistical Signal Processing, Pearson Education Inc., 2002.

Reference Books:

[1] P. P. Vaidyanathan, "Multi-rate Systems and Filter Banks", PHI

Web References:

[1] https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/
[2] https://www.tutorialspoint.com/e_commerce/index.htm

Journals References:

[1] Journal of Digital Signal Processing, Elsevier
[2] IEEE Signal Processing Magazine
[3] Journal of Signal Processing Systems, Springer

Title: Seminar **Code:**

L-T-P scheme: 0-0-4 **Credit: 2**

Prerequisite: Students must have already studied the courses, "*ECE Design and Simulation Lab-I*" and "*ECE Design and Simulation Lab –II*".

Objective:

Students will be able to understand the identification of different areas and new technologies related to electronics and communications.

Learning Outcomes:

Course Outcome	Description
CO1	Outline the seminar topics with respect to their needs for the society.
CO2	Description of usefulness of the work in the context of present application
CO3	Development of the literature survey in chronological order
CO4	Identification of the problem in current areas of electronics
CO5	Application and usefulness to the society.
CO6	Demonstration and deployment of basic block diagram/algorithm steps of the methods.

Course Content:

Unit 1: Motivation about Seminar Topic

Unit 2: Usefulness of the work in the context of present application

Unit 3: Literature survey in chronological order.

Unit 4: Problem identification

Unit 5: Study / Analysis of different existing methods based on adequate performance parameters.

Unit 6: Mathematical formulation of the method.

Unit 7: Block Diagram/Algorithm Steps of the method.

Teaching Methodology:

This course is introduced to help students the basic fundamental areas of electronics and communications. It also introduces knowledge of new technologies to grow in this field.

Evaluation Scheme:

Exams		Marks	Coverage
Presentation-1		20 Marks	**Unit 1-Unit 3**
Presentation-2		30 Marks	**Unit 4-Unit 7**
Day to Day Work	Attendance and Discipline	15 Marks	**50 Marks**

	Sincerity and Regularity	20 Marks	
	Report	15 Marks	
Total		**100 Marks**	

Learning Resources:

Students with concern to the faculty will develop some new areas in the field of electronics and communications and related information they will acquire from the faculty and internet.

Text Books:

[1] Proceedings of the Multi-Conference, Himanshu B. Soni, Universal Publishers, 2011.

[2] Electronics for you (Monthly Magazine).

Reference Books/Material:

[1] "Electronics project management and design", D. Joseph Stadtmiller, Pearson; 1 edition 2000.

[2] "50 Electronics Projects for Beginners", A. K.Maini, Pustak Mahal; First Edition 2007.

Web References:

[1] https://www.engineersworldonline.com

[2] https://www.seminarsonly.com

Journals References:

[1] Journal of Communications Technology and Electronics

[2] IEEE Transaction on communication

[3] Science direct journal of digital control system

[4] IRE Transactions on Industrial Electronics

Title of Course: Dissertation Part-I **Course Code:**

L-T-P Scheme: 0-0-8 **Credits: 04**

Prerequisite: Students must have already studied the basic courses like, "*Advanced digital signal processing*", "*VLSI design*" etc.

Objective:

To study of literature survey, formulate the research problem and develop necessary methodology related to research problem. A workable design/ algorithm to be developed based on the proposed methodology, algorithm a design to be noted.

Learning Outcomes:

Course Outcome	Description
CO1	Outline the dissertation topics with respect to their needs for the society.
CO2	Description of usefulness of the work in the context of present application
CO3	Development of the literature survey in chronological order
CO4	Identification of the problem in current areas of electronics
CO5	Application and usefulness to the society.
CO6	Demonstration and deployment of basic block diagram/algorithm steps of the methods.

Course Content:

Unit 1: Motivation about dissertation Topic

Unit 2: Usefulness of the work in the context of present application

Unit 3: Literature survey in chronological order.

Unit 4: Problem formulation.

Unit 5: Study / Analysis of different existing methods based on adequate performance parameters.

Unit 6: Mathematical formulation of the proposed method.

Unit 7: Block Diagram/Algorithm Steps of the proposed method.

Teaching Methodology:

This course is introduced to help students the basic fundamental areas of electronics and communications. Student must spend two hours daily in library to analyze the problem. It is also essential for student to meet supervisor twice in a week to discuss the research problem. After four weeks of registration the first evaluation has been done before committee to revive the literature survey and formulation of the problem. In second the evaluation, the student has to show the progress of work in terms of design level, mathematical model/ algorithm etc. At end of semester, simulation based design has been analyzed by the committee.

Evaluation Scheme:

Exams		Marks	Coverage
Presentation-1		15 Marks	**Unit 1-Unit 3**
Presentation-2		15 Marks	**Unit 4-Unit 5**
Presentation-3		20 Marks	**Unit 6-Unit 7**
Day to day work	Attendance	10 Marks	**50 Marks**
	Sincerity	10 Marks	
	Report	15 Marks	
	Performance	15 Marks	
Total		**100 Marks**	

Learning Resources:

Students with concern to the faculty will develop some new areas in the field of electronics and communications and related information they will acquire from the faculty and internet.

Text Books:

[1] Proceedings of the Multi-Conference, Himanshu B. Soni, Universal Publishers, 2011.

[2] Electronics for you (Monthly Magazine).

Reference Books/Material:

[1] "Electronics project management and design", D. Joseph Stadtmiller, Pearson; 1 edition 2000.

[2] "50 Electronics Projects for Beginners", A.K. Maini, Pustak Mahal; First Edition 2007.

Web References:

[1] https://www.engineersworldonline.com

[2] https://www.seminarsonly.com

Journals References:

[1] Journal of Communications Technology and Electronics

[2] IEEE Transaction on communication

[3] Science direct journal of digital control system

[4] IRE Transactions on Industrial Electronics

Title: Dissertation Part-II **Code:**

L-T-P Scheme: 0-0-30 **Credit: 15**

Prerequisite: Students must have already studied the basic courses like, "*Advanced digital signal processing*", "*VLSI design*" etc.

Objective:

1. To study of literature survey, formulate the research problem and develop necessary methodology related to research problem. A workable design/ algorithm to be developed based on the proposed methodology, algorithm a design to be noted.

Learning Outcomes:

Course Outcome	Description
CO1	Outline the dissertation topics with respect to their needs for the society.
CO2	Description of usefulness of the work in the context of present application
CO3	Development of the literature survey in chronological order
CO4	Identification of the problem in current areas of electronics
CO5	Application and usefulness to the society.
CO6	Demonstration and deployment of basic block diagram/algorithm steps of the methods.

Course Content:

Unit 1: Motivation about dissertation Topic

Unit 2: Usefulness of the work in the context of present application

Unit 3: Literature survey in chronological order.

Unit 4: Problem formulation.

Unit 5: Study / Analysis of different existing methods based on adequate performance parameters.

Unit 6: Mathematical formulation of the proposed method.

Unit 7: Block Diagram/Algorithm Steps of the proposed method.

Teaching Methodology:

This course is introduced to help students the basic fundamental areas of electronics and communications. Student has to spend two hours daily in library to analyze the problem. It is also essential for student to meet supervisor twice in a week to discuss the research problem. After four weeks of registration the first evaluation has been done before committee to revive the literature survey and formulation of the problem. In second the evaluation, the student has to show the progress of work in terms of design level, mathematical model/ algorithm etc. At end of semester, simulation based design has been analyzed by the committee.

Evaluation Scheme:

Exams		Marks	Coverage
Presentation-1		15 Marks	**Unit 1-Unit 3**
Presentation-2		15 Marks	**Unit 4-Unit 5**
Presentation-3		20 Marks	**Unit 6-Unit 7**
Day to day work	Attendance	10 Marks	**50 Marks**
	Sincerity	10 Marks	
	Report	15 Marks	
	Performance	15 Marks	
Total		**100 Marks**	

Learning Resources:

Students with concern to the faculty will develop some new areas in the field of electronics and communications and related information they will acquire from the faculty and internet.

Text Books:

[1] Proceedings of the Multi-Conference, Himanshu B. Soni, Universal Publishers, 2011.

[2] Electronics for you (Monthly Magazine).

Reference Books/Material:

[1] "Electronics project management and design", D. Joseph Stadtmiller, Pearson; 1 edition 2000.

[2] "50 Electronics Projects for Beginners", A.K.Maini, Pustak Mahal; First Edition 2007.

Web References:

[1] https://www.engineersworldonline.com

[2] https://www.seminarsonly.com

Journals References:

[1] Journal of Communications Technology and Electronics

[2] IEEE Transaction on communication

[3] Science direct journal of digital control system

[4] IRE Transactions on Industrial Electronics

Title of Course: Analogue VLSI Design **Course Code: EC710**
L-T-P Scheme: 3-0-0 **Credit: 3**

Prerequisite: Students should be studied the courses, *"VLSI Design"*.

Objective:
1. To develop and understand the concept of Analog VLSI circuit design.
2. To design the linear CMOS Circuits by using the CMOS amplifier.

Learning Outcomes:

Course Outcome	Description
CO1	Outline various second order effects, Small signal equivalent circuit for MOSFETs, Noise in MOSFETs.
CO2	Description of the Single Stage Amplifier, Current Sources, Source Follower and Differential Stage Amplifier.
CO3	Development of the design of Operational Transconductance Amplifier, Operational Amplifier.
CO4	Identification and use of various cost estimation techniques used in analog IC design.
CO5	Application of IC design techniques on a given assignment.
CO6	Demonstration and deployment of Analog CMOS circuit/layout for Oscillators.

Course Content:
Unit 1: Introduction, Structure of MOSFET, V/I characteristics, Parasitic Capacitance, Second order effects.

Unit 2: Small signal equivalent circuit for MOSFETs and Noise in MOSFETs.

Unit 3: Single Stage Amplifier, Current Sources, Source Follower, Differential Stage Amplifier.

Unit 4: Operational Trans- conductance Amplifier, Operational Amplifier.

Unit-5: Switched Capacitor Filters, Analog CMOS Layout Issues, Oscillators.

Teaching Methodology:
This course is introduced to help students to understand the basics of analog MOS IC circuit design. Starting from frontend development, the student will slowly progress to become to other aspects of design including CMOS circuits. Analog circuit technologies those are helpful for analog IC designer. The entire course is based on: back-end designs & Technologies. Each section includes multiple circuit technologies to help a student to gain analog circuit design experience.

Evaluation Scheme:

Exams	Marks	Coverage

Test-1	15 Marks	Based on Unit-1
Test-2	25 Marks	Based on Unit-2, Unit-3 and around 30% from coverage of Test-1
Test-3	35 Marks	Based on Unit-4 to Unit-5 and around 30% from coverage of Test-2
Assignment	10 Marks	
Tutorials	5 Marks	
Quiz	5 Marks	
Attendance	5 Marks	
Total	**100 Marks**	

Learning Resources:
Tutorials and lecture notes/slides on analog VLSI Design (will be added from time to time): Digital copy will be available on the JUET server.

Text Books:

[1] B. Razavi, Design of Analog CMOS Integrated Circuits, TMH 2001
[2] Philip E. Allen, Douglas R. Holberg, CMOS Analog Circuit Design (2nd Edition), Oxford Univ. Press, 2003.
[3] Paul R. Gray. Paul J. Hurst, Stephen H. Lewis and Robert G. Meyer, Analysis and Design of Analog Integrated Circuits (4th Edition), John Wiley & Sons, 2001.

Reference Books:

[1] D.A. Johns, K. Martin, Analog Integrated Circuit Design, J. Wiley & Sons, 1997.
[2] R. Gregorian, G.C. Temes, Analog MOS Integrated Circuits for Signal Processing, John Wiley & Sons, Inc., 1986.
[3] Y.P. Tsividis, Operation and Modeling of the MOS Transistor, New York: McGraw-Hill, 1987.
[4] BSIM3v3 User Manual, University of California, Berkeley.

Web References:

[1] https://www.udemy.com/
[2] https://swayam.gov.in/nd1_noc20_ee29/preview

Journals References:

[1] VLSI Design— An Open Access Journal - Hindawi
[2] IEEE Transactions on Very Large Scale Integration