

**DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

**NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI**

<b>COURSE PLAN – PART I</b>			
<b>Name of the programme and specialization</b>	<b>M-Tech –VLSI SYSTEM</b>		
<b>Course Title</b>	<b>Analog VLSI</b>		
<b>Course Code</b>	<b>EC651</b>	<b>No. of Credits</b>	<b>3</b>
<b>Course Code of Pre-requisite subject(s)</b>			
<b>Session</b>	<b>July 2023</b>	<b>Section (if, applicable)</b>	
<b>Name of Faculty</b>	<b>Dr. Varun P. Gopi</b>	<b>Department</b>	<b>ECE</b>
<b>Email</b>	<b>varun@nitt.edu</b>	<b>Telephone No.</b>	<b>+919995114547</b>
<b>Name of Course Coordinator(s) (if, applicable)</b>			
<b>E-mail</b>		<b>Telephone No.</b>	
<b>Course Type</b>	<b>Core course</b>		
<b>Syllabus (approved in BoS)</b>			
<p>Basic MOS Device Physics – General Considerations, MOS I/V Characteristics, Second Order effects, MOS Device models. Short Channel Effects and Device Models. Single Stage Amplifiers – Basic Concepts, Common Source Stage, Source Follower, Common Gate Stage, Cascode Stage.</p> <p>Differential Amplifiers – Single Ended and Differential Operation, Basic Differential Pair, Common Mode Response, Differential Pair with MOS loads, Gilbert Cell. Passive and Active Current Mirrors – Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors.</p> <p>Frequency Response of Amplifiers – General Considerations, Common Source Stage, Source Followers, Common Gate Stage, Cascode Stage, Differential Pair. Noise – Types of Noise, Representation of Noise in circuits, Noise in single stage amplifiers, Noise in Differential Pairs.</p> <p>Feedback Amplifiers – General Considerations, Feedback Topologies, Effect of Loading. Operational Amplifiers – General Considerations, One Stage Op Amps, Two Stage Op Amps, Gain Boosting, Common – Mode Feedback, Input Range limitations, Slew Rate, Power Supply Rejection, Noise in Op Amps. Stability and Frequency Compensation.</p> <p>Bandgap References, Introduction to Switched Capacitor Circuits, Nonlinearity and Mismatch.</p>			
<b>COURSE OBJECTIVES</b>			

<ol style="list-style-type: none"> <li>To develop the ability to design and analyze MOS based Analog VLSI circuits to draw the equivalent circuits of MOS based Analog VLSI and analyze their performance.</li> <li>To develop the skills to design analog VLSI circuits for a given specification</li> </ol>	
<b>COURSE OUTCOMES (CO)</b>	
<b>Course Outcomes</b>	<b>Aligned Programme Outcomes (PO)</b>
1. To draw the equivalent circuits of MOS based Analog VLSI and analyze their performance	PO 1,2,3
2. To design analog VLSI circuits for a given specification	PO 1,2,3
3. To analyze the frequency response of the different configurations of an amplifier.	PO 1,2,3
4. To understand the feedback topologies involved in the amplifier design	PO 1,2,3
5. To appreciate the design features of the differential amplifiers	PO 1,2,3

<b>COURSE PLAN – PART II</b>			
<b>COURSE OVERVIEW</b>			
This course focuses on different imaging modalities like, CT, MRI, PET, SPECT, Ultrasound. Mainly the working principle and image acquisition. Different signal processing methods for medical image processing is discussed.			
<b>COURSE TEACHING AND LEARNING ACTIVITIES</b>			
<b>S.No.</b>	<b>Week/Contact Hours</b>	<b>Topic</b>	<b>Mode of Delivery</b>
1	<b>1 WEEK (3 contact hours)</b>	Basic MOS Device Physics – General Considerations, MOS I/V Characteristics.	Chalk & Talk, PPT
2	<b>2 WEEK (3 contact hours)</b>	Second Order effects, MOS Device models. Short Channel Effects and Device Models.	
3	<b>3WEEK (3 contact hours)</b>	Single Stage Amplifiers – Basic Concepts, Common Source Stage, Source Follower, Common Gate Stage, Cascode Stage.	
4	<b>4 WEEK (3 contact hours)</b>	Differential Amplifiers – Single Ended and Differential Operation, Basic Differential Pair, Common Mode Response.	

5	<b>5 WEEK (3 contact hours)</b>	Differential Pair with MOS loads, Gilbert Cell. Passive and Active Current Mirrors – Basic Current Mirrors, Cascode Current Mirrors, Active Current Mirrors.
6	<b>6 WEEK (3 contact hours)</b>	Frequency Response of Amplifiers – General Considerations.
7	<b>7 WEEK (3 contact hours)</b>	Common Source Stage, Source Followers, Common Gate Stage.
8	<b>8 WEEK (3 contact hours)</b>	Cascode Stage, Differential Pair. Noise – Types of Noise, Representation of Noise in circuits, Noise in single stage amplifiers, Noise in Differential Pairs.
9	<b>9 WEEK (3 contact hours)</b>	Feedback Amplifiers – General Considerations, Feedback Topologies, Effect of Loading.
10	<b>10 WEEK (3 contact hours)</b>	Operational Amplifiers – General Considerations, One Stage Op Amps, Two Stage Op Amps, Gain Boosting.
11	<b>11 WEEK (3 contact hours)</b>	Common – Mode Feedback, Input Range limitations, Slew Rate, Power Supply Rejection.
12	<b>12 WEEK (3 contact hours)</b>	Noise in Op Amps. Stability and Frequency Compensation
13	<b>13 WEEK (3 contact hours)</b>	Bandgap References, Introduction to Switched Capacitor Circuits, Nonlinearity and Mismatch.

**COURSE ASSESSMENT METHODS (shall range from 4 to 6)**

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assignment 1	4 <sup>th</sup> Week		10
2	Close book (Descriptive Type Examination) (Module 1 & 2)	7 <sup>th</sup> Week	60 Minutes	15
3	Quiz	9 <sup>th</sup> Week		10

4	Close book (Descriptive Type Examination) (Module 3 & 4)	10 <sup>th</sup> Week	60 Minutes	15
5	Compensation Assessment*	11 <sup>th</sup> WEEK	60 minutes	Please refer course policy for more details
6	Final Assessment * (All Modules)	113 <sup>th</sup> Week	180 Minutes	50

**\*mandatory; refer to guidelines on page 4**

**COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)**

1. The students through class representative may give their feedback at any time which will be duly addressed.
2. Feedback from the students through MIS and class committee meetings

**COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)**

**MODE OF CORRESPONDENCE (email/ phone etc)**

All the students are advised to come to the class regularly. All the correspondence (schedule of classes/ schedule of assignment/ course material/ any other information regarding this course) will be intimated in the class as well as in group mail.

**COMPENSATION ASSESSMENT POLICY**

If any student who fails to attend assessment 2 or assessment 4 due to any genuine reasons, student is permitted to attend compensation assessment for the weightage of 15% (Including Assessment 2 & Assessment 4 Portions)

**ATTENDANCE POLICY** (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

**ACADEMIC DISHONESTY & PLAGIARISM**

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC

chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

The above policy against academic dishonesty shall be applicable for all the programmes.

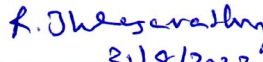
**ADDITIONAL INFORMATION**

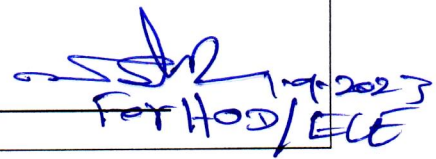
The faculty is available for consultation at times as per the intimation given by the faculty

**FOR APPROVAL**

  
Dr. Varun P. Gopi  
Course Faculty

CC-Chairperson

  
R. Jheeravathy  
31/8/2022 HOD

  
For HOD/ECE

**Guidelines:**

- a) The number of assessments for a course shall range from 4 to 6.
- b) Every course shall have a final assessment on the entire syllabus with at least 30% weightage.
- c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered. Details of compensation assessment to be specified by faculty.
- d) The passing minimum shall be as per the regulations.
- e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.
- f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.
- g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.