1. **Course Title**:
   Microelectronic Circuit Designs

2. **Course Code:**
   EE3132

3. **Course Aims and Objectives:**
   It is an introductory course on VLSI microelectronic circuit designs. The course intends to present the student a solid foundation of custom VLSI design using CMOS technology including VLSI design methodology, circuit operation and characteristics, basic digital circuit implementation, data path and control path design and digital system design. It reinforces the basic materials taught in the course with practical hands-on experience in the design process with state-of-the-art CAD tools.

4. **Units:** 3

5. **Level:** B3

6. **Syllabus:**

   Syllabus discusses the topics of: MOSFET Circuit Characterization, Design Methodology, CMOS Logic Families and Timing Analysis, Data Path and Control Path Design.

   6.1 Design Methodologies

   Top-Down Design and Bottom-Up Design, VLSL Fabrication Process.

   6.2 Digital CMOS Circuit Characteristics

   MOSFET Characterization, Basic Digital Circuit Concepts, CMOS Inverter Characteristics, Dynamic Characteristic of CMOS Inverter, Rise Time, Fall Time and Propagation Delay Analysis, The Power Delay Product, Power Estimation, MOSFET Capacitance, Input and Output Capacitance of CMOS Inverter.

   6.3 CMOS Logic Families

   Static CMOS Logic, Complex CMOS Logic, Transmission Gate CMOS Logic, Complementary Pass Transistor Logic, Low Power Logic Families, Differential Logic Families, Dynamic CMOS Logic, Domino CMOS logic, NORA Logic, Zipper CMOS Logic, Dynamic Pseudo-2-Phase Logic, Single Clock Dynamic Logic, True Single Phase Clock Logic.

   6.4 CMOS Sub-System Design

   Data Path Design, Flip-flop, Register, Latches, Adder, Subtractor, Multiplier, Divider, Multiplexer, Decoder, Encoder, Arithmetic Logic Unit Design, Memory Element, Control Path Design, Finite State Machine, PLA Control Implementation, ROM Control Implementation.

7. **Teaching Methods:**

Teaching is conducted in 2-hour sessions which are in the form of combined lecture and class discussions, with special emphasis on problem solving, hands-on experience and design exercises. Coursework consists of a term project to reinforce the design aspects of the course, assignments and tests.

Teaching Pattern

Duration of course:	1 Semester	
Offered in:	Semester B	
Total Hours:	Lectures	26 hours
	Tutorials	8 hours
	Laboratories	12 hours

8. **Assessment Pattern:**

Examination duration: 2 hours, at the end of the semester
Percentage of coursework, examination, etc.: 60% CW (Term Project - 40%
Assignment, Test - 20%)
40% Exam

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained, and a laboratory attendance of at least 75% recorded.

9. **Pre-requisites:**
Nil

10. **Pre-cursor:**
Nil

11. **Exclusive Courses:**
Nil

12. **Equivalent Old Course Code and Title:**
Nil

13. **Booklist:**

Essential Reading

N Weste and K Eshraghian: Principles of CMOS VLSI Design A System Perspective, (2nd Ed, Addison-Wesley, 1993)

Supplementary Reading

A Brown: VLSI Circuits and Systems in Silicon, (McGraw-Hill, 1991)

L A Glasser and D W Dobberpuhl: The Design and Analysis of VLSI Circuits, (Addison Wesley, 1985)

J P Uyemura: Fundamentals of MOS Digital Integrated Circuits, (Addison-Wesley, 1988)

Fabricius : Introduction to VLSI Design, (McGraw-Hill, 1990)