Electronic Circuit Design

Code	Credit Hours
EE-313	3-1

Course Description

This is the second course in the sequence of the two courses on microelectronic circuits. The objective of this course is to provide the students an insight into the analysis and design of electronic circuits that find extensive application in such fields as computers, control systems, digital instrumentation, and communications etc. The course begins with an introduction to single-stage IC amplifiers and continues with differential and multistage amplifiers, in both their bipolar and MOSFET forms followed by various output stages. Frequency response of amplifiers, feedback analysis with focus on practical circuit applications of negative feedback and stability problems in feedback amplifiers are also presented. The dc and small-signal analysis of the operational amplifier is studied in detail.

Text Book:

1. Sedra & Smith, “Microelectronics Circuits 7th Edition” Oxford University Press

Reference Book:

1. Behzad Razavi, “Fundamentals of Microelectronics”, John Wiley & Sons Inc

Prerequisites

EE-215 (Electronic Devices & Circuits)

ASSESSMENT SYSTEM FOR THEORY

Quizzes	10%
Assignments	10%
Mid Terms	30%
ESE	50%

ASSESSMENT SYSTEM FOR LAB

Quizzes	10%-15%
Assignments	5% - 10%
Lab Work and Report	70-80%
Lab ESE/Viva	20-30%

Teaching Plan

Week No	Topics	Learning Outcomes
1-3	Building Blocks of Integrated Circuit Amplifiers	IC Design Philosophy Comparison of the MOSFET and the BJT IC Biasing-Current Sources, Current Mirrors and Current Steering Circuits The Amplifiers with Active Loads The CS and CE Amplifiers with Active Loads The CG and CB Amplifiers with Active Loads The CS and CE Amplifiers with Source (Emitter) Degeneration The Source and Emitter Followers Some Useful Transistor Pairings
4-7	Differential and Multistage Amplifiers	The MOS Differential Pair Small-Signal Operation Common-Mode Gain Common-Mode Rejection Ratio (CMRR) The BJT Differential Pair Basic Operation Large Signal Operation Small Signal Operation Other Non-ideal Characteristics of Differential Amplifier Differential Amplifier with Active Loads
8-9	Frequency Response	Low frequency Response of BJT Low frequency Response of MOSFET Internal Capacitances in BJT & MOSFET High frequency response of BJT High frequency response of MOSFET
10	**Mid Semester Exams**	
11-13	Feedback	The General Feedback Structure Properties of Negative Feedback Four Basic Feedback Topologies The Series-Shunt Feedback Amplifiers The Series-Series Feedback Amplifiers The Shunt-Shunt Feedback Amplifiers The Shunt-Series Feedback Amplifiers The Stability Problem

14-15	Output Stage and Power Amplifier	Classification of Output Stages Class A Output Stage Class B Output Stage Class AB Output Stage Biasing the Class AB Circuit CMOS Class AB Output Stages Power BJT
16-17	Operational – Amplifier Circuits	The 741 Op-Amp Circuit The Input Stage The Second Stage The Output Stage DC Analysis of the 741(ed 6) Small-Signal Analysis of Input Stage Small-Signal Analysis of Second Stage Small-Signal Analysis of Output Stage Short circuit Protection Circuitry
18	**End Semester Exams**	

Practical:

Experiment No	Description
1	Simulation Using Advanced Features of PSpice
2	Common Emitter Amplifier
3	Cascade amplifier
4	Current Sources
5	BJT Current Mirror Circuit (BJT Wilson Current Mirror)
6	BJT Current Mirror Circuit (BJT Wilder Current Source)
7	Differential Pair with resistive Load
8	Differential pairs with active load
9	Differential amplifier (common mode gain and common mode rejection ratio)
10-11	Differential pair (Mismatching and offset Null adjustment)
12-13	Operational amplifier with negative Feedback
14	Operational amplifier feedback topology
15	Lab Exam