

EE3122: ANALOGUE CIRCUIT FUNDAMENTALS

Effective Term

Semester A 2025/26

Part I Course Overview

Course Title

Analogue Circuit Fundamentals

Subject Code

EE - Electrical Engineering

Course Number

3122

Academic Unit

Electrical Engineering (EE)

College/School

College of Engineering (EG)

Course Duration

One Semester

Credit Units

3

Level

B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction

English

Medium of Assessment

English

Prerequisites

EE2005 Electronic Devices and Circuits

Or

EE2301 Basic Electronic Circuits

Precursors

Nil

Equivalent Courses

EE3110 Analogue Electronic Circuits

Exclusive Courses

Nil

Part II Course Details

Abstract

The aims of the course are to present the techniques used in the analysis of analogue circuits and to apply them to a spectrum of different uses.

Course Intended Learning Outcomes (CILOs)

CILOs		Weighting (if DEC-A1 app.)		DEC-A2	DEC-A3
1	Analyze the functions of the basic analogue circuit building blocks			x	
2	Apply basic analogue building blocks in amplifier design and construction			x	
3	Apply feedback principle to design of amplifiers and stability assessment		x	x	
4	Use small signal models to analyze AC gain, input and output impedances of transistor based amplifiers.		x	x	

A1: Attitude

Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability

Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments

Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

LTAs		Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Students will participate in lectures given on the basic principles and typical applications. Students are guided to tackle problems.	1, 2, 3, 4	2 hrs/wk
2	Tutorials	Students will engage in solving examples problems showing the application of basic theory learnt in lectures.	1, 2, 3, 4	1 hrs/wk (3 weeks lab)

Assessment Tasks / Activities (ATs)

ATs		CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Tests (min.: 2)	1, 2, 3, 4	30	Summative	No
2	#Assignments (min.: 3)	1, 2, 3, 4	10	Formative	Yes

3	Lab Exercises and Reports	1, 2, 3	10	Formative	Yes
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Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

Remark: To pass the course, students are required to achieve at least 30% in coursework and 30% in the examination. Also, 75% laboratory attendance rate must be obtained. # may include homework, tutorial exercise, project/mini-project, presentation

Assessment Rubrics (AR)**Assessment Task**

Examination

Criterion

Achievements in CILOs

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Assessment Task

Coursework

Criterion

Achievements in CILOs

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching marginal levels

Part III Other Information

Keyword SyllabusRevision on Transistor Circuits Modeling

BJT/MOSFET typical operations, Input/output characteristics, single-stage amplifier; biasing/quiescent and AC small-signal conditions; common-emitter/source (BJT/MOSFET) amplifier; small-signal model; input and output impedances; voltage gain. Emitter/source follower and output stage, multistage amplifier

Analogue Building Blocks

Differential amplifiers: reject noise, current mirrors: current source, active load. Output stage/power amplifier: class A, class B and class AB power amps..

Operational Amplifier

Revision on ideal op-amp circuit analysis, special functions of op-amps, non-ideal op-amps, slew rate, bandwidth

Frequency Response of Amplifiers

Low frequency response: coupling and bypass capacitors; high-frequency response: parasitic capacitors and Miller effect; band-limiting and 3dB roll-off frequency. Use of Bode plots.

Feedback Amplifiers

Two-Port network: Impedance parameters, admittance parameters, hybrid parameters, transmission parameters. Ideal feedback amplifiers: gain stability, signal-to-noise ratio, effects on gain and bandwidth. Types of feedback amplifiers; loading effects. Practical feedback amplifiers: voltage amplifier, transadmittance amplifier, transimpedance amplifier, current amplifier, prediction of stability, frequency response.

Small-signal Analysis

Small-signal model for BJT & MOS single transistor amplifiers; Small-signal model for differential amplifiers; AC gain; Input Impedance; Output impedance

Laboratory/Mini-project Experiment:

Students will form groups with size 3-5 to achieve a mini-project with progressing complexity. They need to apply problem solving skills with the concepts learnt to fulfill the given goal through team work.

Reading List**Compulsory Readings**

Title	
1	P. R. Gray, P. J. Hurst, S. H. Lewis and R. G. Meyer: Analysis and Design of Analog Integrated Circuits, 6th Edition, (Wiley, 2017)

Additional Readings

Title	
1	A. S. Sedra, K. C. Smith, T. C. Carusone and V. Gaudet: Microelectronics, 8th Edition, (Oxford Series in Electrical Engineering, 2019)

2	J. Millman, C. C. Halkias and S. Jit: Electronic Devices and Circuits, 2nd Edition, (Tata McGraw Hill, 2007)
3	D. A. Neaman: Microelectronics: Circuit Analysis and Design, 3rd Edition, (McGraw-Hill, 2007)