EE3122: ANALOGUE CIRCUIT FUNDAMENTALS

Effective Term
Semester A 2022/23

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 app.)	DEC-A1	DEC-A2	DEC-A3
1	Analyse 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	Analyze the link between stability and oscillation, and extend the feedback principle to oscillator design		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.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Lectures are given on the basic principles and typical applications. Students are guided to tackle problems.	1, 2, 3, 4	3 hrs/wk
2	Lab exercises and reports	Enables students to put into practice what they learnt in class. Students will have a structured laboratory session followed by a practical design problem.	1, 2, 3	3 hrs/wk (3 weeks lab)

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Tests (min.: 2)	1, 2, 3, 4	30	
2	#Assignments (min.: 3)	1, 2, 3, 4	10	
3	Lab Exercises and Reports	1, 2, 3	10	

Continuous Assessment (%)

50

Examination (%)

50

Examination Duration (Hours)

2

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 Syllabus

Revision 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.

Oscillators
Oscillation conditions and Barkhausen criterion; loop gain, phase shift, Oscillator circuits: Wein bridge, phase shift; Colpitts and Hartley oscillators; piezoelectric crystal oscillators.

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)