NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF SCIENCES
PHYSICS PROGRAM

CF382 – ANALOG ELECTRONIC CIRCUITS

I. GENERAL INFORMATION

CODE	**:**	CF382 Analog Electronic Circuits
SEMESTER	**:**	6
CREDITS	**:**	4
HOURS PER WEEK	**:**	8 (Theory – Practice)
PREREQUISITES	**:**	CF221 Physics III
CONDITION	**:**	Compulsory

II. COURSE DESCRIPTION

At the end of the course the student will be able to: Explain and apply basic circuits with diodes in operation such as: voltage limiter, interlocker, rectifier and multiplier. Analyze and design power supply and regulators with low tension and power Zener diode. Analyze and design polarization circuits with bipolar transistor and MOSFETs. Interpret and apply transistor and diode technical specifications. Analyze and design small signal linear amplifiers with discrete components, bipolar and unipolar transistors in some MHz frequency.

III. COURSE OUTCOMES

1. Rigorously, creatively and carefully analyze, design, specify, simulate and test basic analog circuits, such as, circuits with diodes, power supply and BJT and FET small-signal amplifier.
2. Carefully and rigorously use tools of basic analog circuit analysis and design.
3. Carefully measure basic analog circuit's specification and show concern for using proper measure techniques.
4. Correctly interpret technical characteristics of basic analog circuits.

IV. LEARNING UNITS

1. SEMICONDUCTOR DIODES

Introduction. Characteristic curves. Diode models. Diode nonlinear nature. Small-signal diodes. Diode circuits applications: voltage limiters, interlockers, multipliers.

2. VOLTAGE AND REGULATION SUPPLY

Single-phase rectifier. Power supply. Characteristics. Capacitor-input filter (pi filter), Calculation of ripple factor. Pi filter. Regulation concept. Zener diode as regulator. Voltage and current characteristics. Design of a regulator with charge variation and/or input voltage. Pi filter.

3. BJT AMPLIFIERS
Introduction. Transistor characteristic curves. DC analysis. BJT as amplifier. Hybrid model pi. Graphical analysis. BJT discrete polarization. Stability factors. Polarization with voltage supply. Basic configuration of 2 stage BJT amplifiers. Gain, input and output resistance calculation.

4. MOSFET AMPLIFIERS
Introduction. MOSFET characteristic curves. DC analysis. MOSFET as amplifier. Small-signal model. Polarization of MOS amplifier circuits. MOS amplifiers configurations. The JFET.

5. DIFFERENTIAL AMPLIFIER / 28 HOURS
Introduction. Differential amplifier. Operation of BJT differential amplifier at small signal. Non-ideal characteristics of BJT differential amplifier. Polarization. Multi-stage circuits. Active-charge differential amplifier. Cascade configuration. MOS differential amplifiers. Drop voltage. Current mirrors. Active-charge BICMOS amplifier.

V. LABORATORY EXPERIENCES
The following laboratory experiences are carried out:

- **Lab 1**: Voltage limiter and multiplier circuits.
- **Lab 2**: Filters.
- **Lab 3**: Zener diode.
- **Lab 4**: Polarization and stabilization.
- **Lab 5**: Common-emitter amplifier.
- **Lab 6**: BJT differential amplifier.

VI. METHODOLOGY
The course is carried out in computing lab, theory and practice sessions. In theory sessions, the instructor introduces concepts, theorems and applications. In practice sessions, several problems are solved, and their solutions are analyzed. In lab sessions, a group of lab guides are worked out. In all sessions student's active participation is encouraged through questions and cooperative work.

VII. EVALUATION FORMULA
The average grade PF is calculated as follows:

PF = (EP + EF + ((P1 + P2 + P3 + P4) / 4) / 3

EP: Mid-Term Exam EF: Final Exam P#: Quizzes

VIII. BIBLIOGRAPHY

1. **A. SEDRA - K.SMITH**
   Microelectronic circuits, 5th edition (Spanish)
   Mc-Graw Hill Editorial, 2006

2. **M. HOREINSTEIN**
   Microelectronic circuits and devices (Spanish)
   Prentice Hall Editorial, 2008