NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF ELECTRICAL AND ELECTRONICS ENGINEERING
TELECOMMUNICATIONS ENGINEERING PROGRAM

SYLLABUS - IT514 TELECOMMUNICATIONS II

I. GENERAL INFORMATION

CODE	**:**	IT514
SEMESTER	**:**	7
CREDITS	**:**	4
HOURS PER WEEK	**:**	5 (Theory – Practice)
PREREQUISITES	**:**	EE513 Telecommunication I
CONDITION	**:**	Compulsory
INSTRUCTOR	**:**	Frans Peralta, Alfredo Rodriguez

II. COURSE DESCRIPTION

This course trains the student in the signal sampling theory, Pulse-code modulation PCM, Multi-level pulse-code modulation. Time-division multiplexing (TDM), Plesiochronous digital hierarchy (PDH), Synchronous digital hierarchy (SDH). Digital modulation and demodulation techniques and their corresponding applications in the telecommunication area. ASK, FSK, PSK, MPSK, Spread spectrum modulation, Frequency orthogonal modulation, noise.

III. COURSE OUTCOMES

1. Identify and apply digital encoding techniques, multiplexing in time domain for signal transmission and reception.
2. Analyze, assess and use digital modulation and demodulation techniques in reception and transmission systems.
3. Identify and apply Plesiochronous and Synchronous digital hierarchy standards.
4. Analyze the noise effect in baseband & bandwidth digital transmission and reception systems.

IV. LEARNING UNITS

1. PULSE MODULATION

Sampling theorem / Spectral analysis of the sampled signal / Ideal sampling / bandwidth signal sampling / Signal reconstruction / Sampling pulse shape / PAM, PDM and PPM pulse modulation.

2. PCM MODULATION AND DEMODULATION

Analog-to-digital converter / Uniform quantization / no uniform quantization: A-law compression-expansion / Signal assessment – Quantization noise / PCM encoding / PCM bandwidth / Noise effects / Delta encoding and PCM differential / Multilevel encoding.

3. TIME-DIVISION MULTIPLEXING

Time-division multiplexing / E1 framework structure, E2 framework structure / Justification bits / Plesiochronous digital hierarchy PDH / STM-1 framework structure / Synchronous digital hierarchy (SDH).

4. BANDBASE CODES

Digital transmission and reception system in baseband / Spectral density of unipolar, polar and NRZ & RZ pseudo-ternary code power / Line code / Spectral density of lime codes power / Nyquist criteria / Spectral efficiency / Inter-symbol interference / Adaptive equalization / Error rate / Applications.

5. DIGITAL MODULATION AND DEMODULATION

Digital reception and transmission systems in bandwidth with intermediate and direct frequency modulation / Digital modulation / Advantages and disadvantages of the digital modulation / ASK and FSK Binary digital modulation and demodulation (coherent and non coherent) / PSK, DPSK, MSK binary digital modulation and demodulation / Power spectral density / QPSK, DQPSK, OQPSK, 8PSK, 16PSK, 8QAM and 16QAM multinary digital modulation and demodulation / SSSD and SSFH spread spectrum modulation / OFDM frequency orthogonal modulation / Applications.

6. NOISE / 4 HOURS

Noise / Noise power density / White noise / Thermal noise / Noise figure / Noise temperature / Noise analysis in baseband and bandwidth systems.

V. LABORATORY EXPERIENCES

Lab 1: Analysis of digital signals.
Lab 2: PCM encoding.
Lab 3: Delta encoder.
Lab 4: Delta decoder.
Lab 5: NRZ and RZ bandbase codes.

VI. METHODOLOGY

The course is carried out in computing lab, theory and practice sessions. In theory sessions, the instructor introduces concepts, theorems, technique, technologies and applications. In practice sessions, several problems are solved, and their solutions are analyzed. In lab sessions, students use modules where tests with circuits related to the subject of the course are carried out. In all sessions student's active participation is encouraged.

VII. EVALUATION FORMULA

The average grade PF is calculated as follows:

PF = (EP+EF+((P1+P2+P3)/3+(L1+L2+L3+L4+L5)/5)/2)/3

EP: Mid-Term Exam EF: Final Exam

P#: Quizzes L#: Labs

VIII. BIBLIOGRAPHY

1. **FERREL G. STREMLER**
   Introduction to Communication Systems (Spanish)
   Addison Wesley Editorial

2. **MISCHA SCHWARTZ**
   Information transmission, modulation and noise (Spanish)
   Mc Graw Hill Editorial

3. **LEON W. COUCH**
   Analog and Digital Communication Systems (Spanish)
   Prentice Hall Editorial

4. **WAYNE TOMASI**
   Electronic Communication Systems (Spanish)
   Prentice Hall Editorial