Course Title: Principles of Communications

Course Code: EE3008

Units: 3

Level: B3

Course Aims & Objectives:
This is the first undergraduate course on communications, aiming to introduce you the principles of point-to-point communication. The objective is intended for the students to understand various modulation schemes for analogue- and digital-signal transmission, and to analyse their performance in terms of signal-to-noise ratio, bandwidth requirement, and error performance.

Intended Learning Outcomes:
On completion of this course, the students will be able to:

Upon the completion of this course, the students are expected to grasp two analog modulation schemes, i.e., amplitude modulation (AM) and frequency modulation (FM), two digital modulation schemes, i.e., phase-shift keying (PSK) and frequency-shift keying (FSK), and the techniques to generate PCM sequences from an analog signal. In particular, the students will be able to
1. Describe the generation, transmission, and reception of AM, FM, BPSK, and BFSK signals.
2. Determine the modulation index, frequency components, bandwidth requirement, and power efficiency for AM and FM.
3. Grasp techniques for converting an analog signal into its PCM counterpart.
4. Calculate the performance of PSK and FSK systems.

Syllabus:
Digital Baseband Transmission for Analogue Signal
Formatting analog information: sampling process, aliasing; Pulse amplitude modulation and time division multiplexing; Waveform representation of binary digits; Amplitude quantization: quantization noise, uniform and non-uniform quantizing; Pulse code modulation (PCM), µ-law and A-law companding; Differential PCM and delta modulation.

Analog Modulation-AM
Amplitude Modulation (AM): generation and detection, signal to noise ratio; modulation index; spectral analysis; system bandwidth requirement; single-sideband modulation.

Analog Modulation-FM
Frequency Modulation (FM): Narrowband and wideband FM, FM signal generation; spectral analysis of single-tone FM signals; average power and bandwidth; signal to noise ratio, threshold effect, FM receivers.
Binary Digital Modulation/Demodulation
Phase shift keying, frequency shift keying: generation, differential encoding, coherent & non-coherent detection, error performance in an additive Gaussian channel, bandwidth requirement, multiplexing and T1, applications to satellite and cellular.

Transmission Media
Metallic cable: bandwidth limitation, T1 carrier, EIA interfaces;
Optical fibre: light propagation, optical sources and detectors;
Satellite: orbit & subsystems, multiple access techniques;
Wireless Network: pager, cordless phone, cellular phone, wireless LAN.

Laboratory Experiment:
- Analog Modulation
- Pulse Code Modulation
- Phase Shift keying

Teaching pattern:
Teaching will be in the form of lectures, complemented by tutorials and laboratories. In tutorials, the instructor will interact with the students aiming to establish a two-way communication link between the students and the instructor, so that the concerns and difficulties encountered by the students can be addressed timely and effectively. The laboratory experiments will reinforce students' understanding of the material learnt from the lectures on one hand, and give them hands-on experience on the other.

Duration of course: 1 semester
Suggested lecture/tutorial/laboratory mix: Lecture Hour: 26 hours
Tutorial Hour: 9 hours
Laboratory Hour: 9 hours

Assessment pattern:
Examination duration: 2 hours, at the end of the semester
Percentage of coursework, examination, etc.: 15% CW; 15% Laboratory; 70% Exam

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained, and a laboratory attendance of at least 75% recorded.

Coursework should be based on several different exercises distributed over the period of the semester; examples include homework assignments, short test, mini projects and presentations.

Pre-requisites: (please quote course code & title)
MA2176 or A pass in ‘A’ Level Pure Mathematics or equivalent level

Pre-cursor: (please quote course code & title)
Nil

Exclusive Course: (please quote course code & title)
Nil

Equivalent Courses: (please quote course code & title)
Nil

Equivalent to the Old Course Code and Title:
Nil

**Textbook:**


**Reference Book:**

