

21-22

MASTER INTERUNIVERSITARIO EN  
METODOLOGÍA DE LAS CIENCIAS DEL  
COMPORTAMIENTO Y DE LA SALUD.  
UNED, UCM Y UAM

# GUÍA DE ESTUDIO COMPLETA



## ANÁLISIS DE SEÑALES Y SISTEMAS

CÓDIGO 22201217

UNED

21-22

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Nombre de la asignatura	ANÁLISIS DE SEÑALES Y SISTEMAS
Código	22201217
Curso académico	2021/2022
Título en que se imparte	MASTER INTERUNIVERSITARIO EN METODOLOGÍA DE LAS CIENCIAS DEL COMPORTAMIENTO Y DE LA SALUD. UNED, UCM Y UAM
Tipo	CONTENIDOS
Nº ETCS	5
Horas	125.0
Periodo	SEMESTRE 2
Idiomas en que se imparte	CASTELLANO

## PRESENTACIÓN Y CONTEXTUALIZACIÓN

El análisis de señales es un conjunto de técnicas muy amplio cuya finalidad es obtener información a partir de datos que, usualmente, toman la forma de variables físicas (v.g., voltaje, temperatura, presión, etc.) que cambian en el tiempo (señales temporales). En Psicología ha sido tradicionalmente de una gran utilidad en áreas como Psicología de la Percepción (visual, auditiva, etc.) o en Psicofisiología pero se puede aplicar a cualquier tipo de señal que sirva de entrada (*input*) estimular a un sujeto (v.g., sonidos, imágenes, etc.) o de salida (*output*) del mismo (v.g., EEG, movimientos manuales, EKG, música, etc.). Por ello, el objetivo del seminario de Análisis de Señales y Sistemas consistirá en **introducir** al alumno en los conceptos fundamentales (sistemas, transformada de Fourier, convolución, etc.) para el análisis de cualquier tipo de señal. Debido a que el área es de una gran amplitud, se incidirá especialmente en que el alumno domine los conceptos básicos sin pretender dominar técnicas específicas, para las que necesitará profundizar por su cuenta.

La Psicología, como ciencia natural que trata con información presente en multitud de señales (eléctricas como en el EEG o el EKG, de posición como el estado de movilidad de especímenes en estudio como ratas, angulares como el grado de curvatura de los dedos de la mano en relación al tiempo, etc.), debe analizar estas señales con el objetivo de evaluar las teorías sustantivas existentes sobre distintos fenómenos cognitivos, sensoriales, etc. Es por ello que el Análisis de Señales y Sistemas es un conjunto de técnicas de enorme utilidad en una gran variedad de áreas psicológicas.

Además, engloba técnicas utilizadas usualmente en el ámbito de la ingeniería y, desde la consideración de la Psicología como Ingeniería Inversa, permite al Psicólogo conceptualizar y analizar la conducta desde una perspectiva más próxima a las Ciencias Naturales.

## REQUISITOS Y/O RECOMENDACIONES PARA CURSAR ESTA ASIGNATURA

Se exige inglés a nivel de lectura debido a que el material de estudio que se le proporcionará al alumno se encuentra en este idioma. El material de estudio puede descargarse gratuitamente de la red y/o del propio vínculo existente en el curso.

Es recomendable, aunque no necesario, que el alumno tenga los conocimientos básicos que se imparten en Bachillerato sobre Trigonometría, Cálculo Diferencial e Integral y Variables Complejas.

## EQUIPO DOCENTE

Nombre y Apellidos  
Correo Electrónico  
Teléfono  
Facultad  
Departamento

JOSE MANUEL REALES AVILES  
jmreales@psi.uned.es  
91398-7933  
FACULTAD DE PSICOLOGÍA  
METODOLOGÍA DE LAS CIENCIAS DEL COMPORT.

## HORARIO DE ATENCIÓN AL ESTUDIANTE

Nombre: Dr. D. José Manuel Reales Avilés.

Departamento: Metodología de las Ciencias del Comportamiento

Despacho: 2.59

Horario de tutoría:

Martes: de 10:00 a 14:00 horas.

Miércoles: de 10:00 a 14:00 horas.

Viernes: de 10:00 a 14:00 horas.

Teléfono: **91 398 79 33** 91 398 79 33

Email: **jmreales@psi.uned.es**

## COMPETENCIAS QUE ADQUIERE EL ESTUDIANTE

### COMPETENCIAS GENERALES

CG1 - Tomar conciencia de la importancia de la metodología en la adquisición del conocimiento científico, así como de la diversidad metodológica existente para abordar distintos problemas de conocimiento

CG2 - Desarrollar el razonamiento crítico y la capacidad para realizar análisis y síntesis de la información disponible.

CG3 - Saber identificar las necesidades y demandas de los contextos en los que se exige la aplicación de herramientas metodológicas y aprender a proponer las soluciones apropiadas.

CG4 - Planificar una investigación identificando problemas y necesidades, y ejecutar cada

uno de sus pasos (diseño, medida, proceso de datos, análisis de datos, modelado, informe).

CG5 - Obtener información de forma efectiva a partir de libros, revistas especializadas y otras fuentes.

CG6 - Desarrollar y mantener actualizadas competencias, destrezas y conocimientos según los estándares propios de la profesión.

## RESULTADOS DE APRENDIZAJE

El estudiante aprenderá a identificar las señales presentes en multitud de fenómenos psicológicos (v.g., imágenes cerebrales en fMRI, ERPs en el análisis de los EEG, patrón de presión en señales auditivas, etc.). Una vez identificadas las señales, podrá juzgar el tipo de sistema que las procesa (lineal, estocástico, etc.). Sabrá interpretar un Análisis de Fourier, ya sea en su variante real o compleja y su relación con la convolución. Aprenderá la diferencia entre una transformada de Fourier y la transformada de Laplace.

## CONTENIDOS

### Tema 1

Estadística, probabilidad y ruido

1.1.- Señales y gráficos

1.2.- Media y desviación típica

1.3.- El histograma, la función de densidad de probabilidad (PDF) y la función de probabilidad (PMF)

1.4.- La distribución normal

1.5.- Generación digital de ruido

1.6.- Precisión y exactitud (accuracy)

### Tema 2

Sistemas lineales

2.1.- Señales y sistemas

2.2.- Condiciones para la linealidad

2.3.- Fidelidad estática y sinusoidal

2.4.- Superposición

2.5.- Descomposiciones más comunes de la señal

### Tema 3

#### Convolución

- 3.1.- La función delta y la respuesta al impulso
- 3.2.- Convolución
- 3.3.- El algoritmo de la convolución
- 3.4.- La suma de inputs ponderados

### Tema 4

#### La transformada discreta de Fourier (DFT)

- 4.1.- La familia de transformadas de Fourier
- 4.2.- Notación y formato de la DFT real
- 4.3.- El dominio de la frecuencia
- 4.4.- Funciones base de la DFT
- 4.5.- Síntesis: el cálculo de la DFT inversa
- 4.6.- Aplicaciones de la DFT: Análisis espectral de la señal

### Tema 5

#### Introducción a los filtros digitales

- 5.1.- Concepto de filtro digital
- 5.2.- Representación de la información en la señal
- 5.3.- Parámetros en el dominio del tiempo y la frecuencia
- 5.4.- Filtros de paso alto, paso banda y rechazo de banda
- 5.5.- Clasificación de los filtros

### Tema 6

#### Números complejos

- 6.1.- El sistema de los números complejos
- 6.2.- Notación polar
- 6.3.- Representación compleja de las sinusoides
- 6.4.- Representación compleja de los sistemas

## Tema 7

La transformada compleja de Fourier

7.1.- La DFT compleja

7.2.- La familia de transformadas de Fourier

## Tema 8

La transformada de Laplace

8.1.- Naturaleza del dominio S

8.2.- Estrategia de la transformada de Laplace

8.3.- Polos y ceros

8.4.- Diseños de filtros en el dominio S

## METODOLOGÍA

La metodología utilizada es la propia de la Universidad Nacional de Educación a Distancia, utilizando una variedad de procedimientos educativos con gran hincapié en las nuevas tecnologías de la información.

Las video-clases de la asignatura se encuentran grabadas en la plataforma informática de la UNED (Alf).

## PLAN DE TRABAJO

En el cómputo de horas se incluyen el tiempo dedicado a las horas lectivas, horas de estudio, tutorías, seminarios, trabajos, prácticas o proyectos, así como las exigidas para la preparación y realización de exámenes y evaluaciones.

**TEMA: Sistemas lineales - 12 Horas**

2.1.- Señales y sistemas

2.2.- Condiciones para la linealidad

2.3.- Fidelidad estática y sinusoidal

2.4.- Superposición

2.5.- Descomposiciones más comunes de la señal

**TEMA: Convolución - 12 Horas**

- 3.1.- La función delta y la respuesta al impulso
- 3.2.- Convolución
- 3.3.- El algoritmo de la convolución
- 3.4.- La suma de inputs ponderados

**TEMA: La transformada discreta de Fourier (DFT) - 12 Horas**

- 4.1.- La familia de transformadas de Fourier
- 4.2.- Notación y formato de la DFT real
- 4.3.- El dominio de la frecuencia
- 4.4.- Funciones base de la DFT
- 4.5.- Síntesis: el cálculo de la DFT inversa
- 4.6.- Aplicaciones de la DFT: Análisis espectral de la señal

**TEMA: Introducción a los filtros digitales - 12 Horas**

- 5.1.- Concepto de filtro digital
- 5.2.- Representación de la información en la señal
- 5.3.- Parámetros en el dominio del tiempo y la frecuencia
- 5.4.- Filtros de paso alto, paso banda y rechazo de banda
- 5.5.- Clasificación de los filtros

**TEMA: Números complejos - 12 Horas**

- 6.1.- El sistema de los números complejos
- 6.2.- Notación polar
- 6.3.- Representación compleja de las sinusoides
- 6.4.- Representación compleja de los sistemas

**TEMA: La transformada compleja de Fourier - 12 Horas**

- 7.1.- La DFT compleja
- 7.2.- La familia de transformadas de Fourier

**TEMA: La transformada de Laplace - 12 Horas**

- 8.1.- Naturaleza del dominio S
- 8.2.- Estrategia de la transformada de Laplace
- 8.3.- Polos y ceros



8.4.- Diseños de filtros en el dominio S

**TEMA: Estadística, probabilidad y ruido - 12 Horas**

1.1.- Señales y gráficos

1.2.- Media y desviación típica

1.3.- El histograma, la función de densidad de probabilidad (PDF) y la función de probabilidad (PMF)

1.4.- La distribución normal

1.5.- Generación digital de ruido

1.6.- Precisión y exactitud (accuracy)

**PEC: PEC - 29 Horas**

Las PECs consisten en ejercicios de todos y cada uno de los capítulos del temario.

**PRUEBA PRESENCIAL: 0 horas**

**Total Horas ECTS introducidas aquí : 125**

## SISTEMA DE EVALUACIÓN

### TIPO DE PRIMERA PRUEBA PRESENCIAL

Tipo de examen No hay prueba presencial

### TIPO DE SEGUNDA PRUEBA PRESENCIAL

Tipo de examen2 No hay prueba presencial

### CARACTERÍSTICAS DE LA PRUEBA PRESENCIAL Y/O LOS TRABAJOS

Requiere Presencialidad No

Descripción

Los trabajos consisten en la resolución de 10 cuestiones referentes a todo el material de estudio. Las cuestiones son problemas referentes al análisis de señales.

Criterios de evaluación

Corrección de la respuesta.

Ponderación de la prueba presencial y/o los trabajos en la nota final 100%

Fecha aproximada de entrega 1 de Junio de 2019 en convocatoria ordinaria y 1 de Septiembre en convocatoria extraordinaria.

Comentarios y observaciones

**PRUEBAS DE EVALUACIÓN CONTINUA (PEC)**

¿Hay PEC? No

Descripción

Criterios de evaluación

Ponderación de la PEC en la nota final

Fecha aproximada de entrega

Comentarios y observaciones

**OTRAS ACTIVIDADES EVALUABLES**

¿Hay otra/s actividad/es evaluable/s? No

Descripción

Criterios de evaluación

Ponderación en la nota final

Fecha aproximada de entrega

Comentarios y observaciones

**¿CÓMO SE OBTIENE LA NOTA FINAL?**

Mediante la evaluación de la corrección de los problemas planteados en Alf.

## BIBLIOGRAFÍA BÁSICA

El texto de referencia básico es:

Smith, S. W. (2003). Digital Signal Processing. A Practical Guide for Engineers and Scientists. Elsevier Science, New York.

Se puede descargar gratuitamente de la pag. web: <http://www.dspguide.com/> aunque también se encuentra en formato PDF en la plataforma del curso.

Existen muchos textos adicionales que están específicamente dirigidos a psicólogos. Uno de los más recientes es el trabajo de Mike X. Cohen (2014) "Analyzing neural time series data" dedicado específicamente a señales generadas por el cerebro, ya sean electroencefalográficas o procedentes de la resonancia funcional magnética.

## BIBLIOGRAFÍA COMPLEMENTARIA

Aparte del texto de referencia base, otros textos que pueden servir de ayuda son:

Hsu, H. P. (1995). Signal and Systems. Schaum's Outline, McGraw-Hill.

Loy, G. (2007). Musimathics, vol 2. MIT Press (muy recomendable).

Oppenheim, A.V. &Willsky, A.S. (1983). "Signals and Systems". Prentice Hall

Tan, L. (2008). Digital Signal Processing. Fundamentals and Applications. Elsevier, New York.

## RECURSOS DE APOYO Y WEBGRAFÍA

Sería recomendable, aunque no es necesario, que el estudiante dispusiera de un software de alto nivel como MatLab o Mathematica para poder implementar los algoritmos que se presentan en el texto.

Otro software (como Pyton, Pascal, C++ o Fortran) también se puede utilizar aunque su generalidad es bastante inferior.

## GLOSARIO

### 1. ADC

Analogue-to-Digital Converter. A device for converting an analogue voltage waveform into a series of digital numbers so that the signal can be manipulated numerically ("digitally processed").

### 2. Amplitude Modulation (AM)

One of the methods for transmitting information using radio waves by superimposing the information signal onto a radio frequency carrier wave. The amplitude of the carrier wave is varied in accordance with the time-varying amplitude of the input signal. The frequency of the carrier wave remains unchanged.

### 3. Analogue

A system in which one continuously-varying physical quantity (e.g. the intensity of a sound wave) is represented directly by another (e.g. the voltage of an electrical signal) as faithfully as possible.

### 4. Analogue Modulation

The process of Modulation, where the modulating wave or signal is analogue and the amplitude, frequency or phase of the carrier wave or signal is varied continuously according to the content of the modulating signal.

### 5. ARQ

Automatic Repeat Request. An error detection and correction technique based on the transmission of data in discrete packets. A decoder in the receiver detects errors but cannot correct them. Instead it sends a retransmission request to the transmitter which then repeats the transmission.

### 6. Audio Subcarrier (Television)

A carrier signal modulated by a sound signal, where the carrier frequency is slightly higher than the maximum frequency encountered in a video signal. This signal is combined with a video signal and the combination is used to modulate a radio frequency carrier for subsequent transmission over a satellite link. The signal is referred to as a subcarrier because it is itself modulated onto a carrier.

### 7. Baseband

The range of frequencies occupied by the source electrical signal that is to be transmitted over a radiocommunications link. It is the frequency band occupied by an analogue or data signal prior to modulation and frequency conversion, or after frequency conversion and demodulation. For example, the baseband of a video signal extends from 0 Hz to about 5 MHz.

8. Block Downconversion

The process of converting the frequency of an entire block of radio frequency signals received from the satellite to a lower intermediate frequency (of around 1 GHz). This permits subsequent processing of the signals within a satellite receiver, including selection of the desired signal from the available block of signals.

9. Broadband

A pure frequency signal that is used to convey information through a transmission channel. The key characteristics of the carrier signal (frequency, amplitude or phase) are varied according to the content of the information. These variations are detected at the receiver and are used to reconstruct the original signal.

10. CDMA

Code Division Multiple Access. A technique allowing multiple users to simultaneously share a common transmission bandwidth. Each user transmits continuously, generating a controlled level of interference into other users. Each transmitter is assigned a unique signature, or code, which is combined with the useful information at the transmitter. The receiver is able to recover the desired information and reject unwanted information by means of this unique code.

11. Channel Encoding (Coding)

The process of deliberately adding redundant information to a message at the transmit end of a transmission link so that errors can be detected and corrected at the reception point. The term "channel" is used to indicate that the encoding is specifically related to the transmission channel and to distinguish it from any other encoding used in the system (e.g. for digital image compression).

12. Chrominance (Television)

The colour information of a television picture. It is also used to refer to the modulated colour component of a PAL, SECAM or NTSC television signal.

13. Code Rate

The ratio of the number of bits in a data stream that carry useful information to the total number of bits, including those added for error correction purposes. For example, a code rate of  $\frac{3}{4}$  indicates that  $\frac{3}{4}$  of the bits carry useful information and  $\frac{1}{4}$  of the bits are used to detect and correct errors in the receiver, after which time they are discarded.

#### 14. Colour Bars (Television)

A television picture consisting of several coloured vertical bars, which is used for testing the performance of colour television equipment and transmission paths. There are several variants of the colour bar signal in use worldwide.

#### 15. Colour Difference (Television)

A signal obtained by subtracting the brightness (luminance) information of a television picture from the primary colour information (red or blue). Two colour difference signals (red and blue) are conveyed in a PAL, SECAM or NTSC picture. The third (green) can be deduced in the television receiver from these two colour difference signals and the brightness information.

#### 16. Compression (Coding)

A digital technique for reducing the information needed to represent a still image, a moving image or an audio signal without undue impact on the subjective quality of the processed material. The most important information is retained, whilst repeated or unnecessary information ("redundant" information) is discarded. Such techniques are used to reduce the capacity needed to store and/or transmit photographic, video and audio information.

#### 17. Contrast (Television)

The extent to which adjacent light and dark areas of a television picture differ in brightness.

#### 18. Crosstalk

Interference received in one communication channel from signals conveyed by other communication channels.

#### 19. CVBS (Television)

Composite Video Blanking & Synchs. A baseband television signal containing the picture information (luminance and chrominance) plus all the synchronization signals necessary to display a fully-locked television picture

#### 20. DCT

Discrete Cosine Transform. Used principally in digital video compression systems such as MPEG-2, which are designed to remove unimportant or irrelevant ("redundant") information from television pictures, thus reducing the amount of data to be conveyed to the receiver. Redundant information could be, for example, the static background of a scene in which only a single person or object is moving, which only needs to be sent to the receiver once. The DCT is one mathematical technique for identifying and removing this redundant data without unduly degrading the picture quality.

#### 21. Decoding

The process of restoring a coded signal to its original form based on knowledge of the

encoding process.

#### 22. De-Emphasis

A reduction in the amplitude of the higher frequency portions of a frequency modulated signal (e.g. analogue television) and its accompanying noise after transmission via a radio link. De-emphasis is used in conjunction with a complementary Pre-Emphasis device in the transmitter so that their combined effect on the signal is neutral. The pre-/de-emphasis process improves the signal-to-noise ratio for high frequency signal components and thus the overall quality of the received signal.

#### 23. Demodulation

The act or process by which an output wave or signal is obtained from a carrier wave or signal, where the recovered wave or signal has the characteristics of the original modulating wave or signal. The reverse process of Modulation.

#### 24. Demultiplexing

The extraction of multiple distinct messages or signals from a single composite signal ("multiplex").

#### 25. Digital

A system or device in which discrete signals are used to represent continuous signals in the form of numbers or other characters. Information is represented by electrical "on / off", "high / low" or "1 / 0" pulses, instead of being represented by a continuously-varying quantity (e.g. signal voltage) as is the case in an Analogue system or device.

#### 26. Digital Modulation

The process of Modulation, where the modulating wave or signal is digital and the amplitude, frequency or phase of the carrier wave or signal is varied in discrete steps according to the content of the modulating signal.

#### 27. Digitisation

The transformation of a continuously varying quantity (e.g. signal voltage) into a series of discrete signals in the form of numbers or other characters.

#### 28. Downconversion

The process of converting the frequency of a signal to a lower frequency.

Downconversion is performed at the reception point to permit the recovery of the original signal.

#### 29. Emission

Radiation produced, or the production of radiation, by a radio transmitting station, which can be an earth station or a satellite.

#### 30. Encoding (Coding)

The process of converting a message into a code that is designed to achieve a particular purpose (e.g. error detection and correction, bit rate reduction).

### 31. Encryption

The process of "locking" a signal using secret information so that it can only be deciphered by an authorised recipient who is in possession of the appropriate secret "key". This process is used in Conditional Access systems as a mechanism for controlling and managing subscribers to a particular service or range of services.

### 32. Energy Dispersal

The process of modifying a signal before it is modulated onto a carrier wave so that the energy of the modulated carrier signal is spread as evenly as possible over its bandwidth. The purpose of this process is to reduce the potential of the signal to interfere with other radio frequency signals.

### 33. Error Correction

The process of reconstructing digital information that has been corrupted in the data transmission process. There are two basic variants of error correction: FEC and ARQ. Error correction requires the detection of erroneous data based on observation of the received data (see Error Detection).

### 34. Error Detection

The process of detecting erroneous digital information after data recovery in the receiver. Erroneous information usually results from transmission errors. Error detection exploits the properties of a code applied to the data in the transmitter. See also Error Correction.

### 35. Eurocrypt

Conditional access system used mainly with the D2-MAC television transmission standard.

### 36. FDM

Frequency Division Multiplex. A system in which signals are each allocated a unique portion of a shared frequency range. Each individual signal is modulated and translated in frequency so that it occupies the correct frequency segment of the composite signal spectrum and does not interfere with the other signals sharing the same band of frequencies. Individual signals are recovered from the composite signal by filtering. FDM is used, for example, to convey multiple television signals in a cable distribution system.

### 37. FDMA

Frequency Division Multiple Access. A method allowing multiple carriers to share a single satellite transponder or range of frequencies. The transponder bandwidth is divided into sub-channels, each of which is allocated to a particular earth station (carrier). The earth stations transmit continuously and the transponder conveys several carriers simultaneously at different frequencies.

### 38. FEC

Forward Error Correction. An error detection and correction technique based on the addition of a code to the signal at the transmitter. A decoder in the receiver detects and

corrects errors making use of the properties of this code. The amount of coding information added to the original signal is quantified by the Code Rate.

39. FM

Frequency Modulation. One of the principal methods for transmitting information using radio waves by superimposing the information signal onto a radio frequency carrier wave. The frequency of the carrier wave is varied in accordance with the time-varying amplitude of the input signal. The amplitude of the carrier wave remains unchanged.

40. Frame (Television)

One complete TV picture, composed of two fields and a total of 525 and 625 scanning lines in NTSC and PAL systems, respectively.

41. Frequency Conversion

The process of altering the frequency of a signal so that it is suitable for transmission or other processing.

42. Frequency Translation

See Frequency Conversion.

43. IF

Intermediate Frequency. In radio communication systems, frequency conversion from baseband to the transmission frequency, and from the reception frequency to baseband, is usually carried out in two or more stages. Any frequency obtained after a frequency conversion that does not correspond to the baseband, the transmission frequency or the reception frequency is known as an intermediate frequency. In satellite reception systems the term IF is often used to refer to the frequency range in which the LNB delivers the signals it receives from the satellite (950 - 2150 MHz) to the IRD.

44. Interlaced Scanning (TV)

The process of scanning a single image ("frame") of a moving picture sequence in two sequential stages, where each stage produces a scanned image ("field") comprising one-half of the total number of horizontal lines used in the scanning process. The lines of each field alternate. It is a technique that is used in conventional television systems (e.g. PAL) to reduce the transmission bandwidth by exploiting the properties of the human eye.

45. JPEG

Joint Photographic Experts Group. A group established by the International Organization for Standardization (ISO) that developed a widely-used international standard for the coding of still pictures. The term "JPEG" is often used to refer to the coding method itself, which reduces the information needed to represent the picture with good quality.

46. Luminance (Television)

The brightness information of a television picture. It is also used to refer to the brightness



component (Y signal) of a PAL, SECAM or NTSC television signal.

47. Microwave

The frequency range from approximately 1 to 300 GHz, covering the frequency range suitable for satellite communications.

48. Modulation

To superimpose the amplitude, frequency or phase of a wave or signal onto another wave or signal, which is then used to convey the original signal via a transmission medium (e.g. satellite link).

49. MPEG

Motion Pictures Experts Group. A group established by the International Organization for Standardization (ISO) that establishes international standards for compression coding of moving pictures and audio programmes. The MPEG-2 standard is widely used for compressing video material (e.g. in the DVB standard).

50. MPEG-2

A widely-used video compression standard. See MPEG.

51. Multiple Access

The simultaneous sharing of a common transmission bandwidth by multiple users. In satellite communications, it usually refers to the shared use of one or more transponders by multiple earth stations.

52. Multiplex

A signal that comprises multiple distinct signals or messages, usually for the purposes of transmission via a common communications channel.

53. Multiplexing

The use of a common communications channel for sending two or more messages or signals (e.g. multiple digital television programmes on a single digital carrier, or "multiplex"). Multiplexing is the process of combining multiple signals into a composite signal that is suitable for transmission via the common communications channel.

54. Non-Linear

Refers to a device or process in which the output is not directly proportional to the input. Often used in the satellite communication context to refer to the (undesirable) characteristics of practical high power amplifiers.

55. NTSC (Television)

The National Television Standards Committee, which created the North American conventional television broadcasting standard. The standard itself is also referred to as NTSC.

56. PAL (Television)

Phase Alternating Line. A European conventional colour television standard, which evolved from the American NTSC standard. The term "Phase Alternating Line" refers to

the technique used to overcome the colour variations that can occur in the NTSC system.

57. Parabola

A geometric shape formed by the intersection of a cone by a plane parallel to its side.

58. Parabolic

Shaped like a parabola or paraboloid.

59. Parabolic Antenna

An antenna having a main reflector surface that is a paraboloid or is shaped like a paraboloid. It has the property of reflecting parallel incoming signals to a single focal point.

60. Paraboloid

A geometric surface whose sections parallel to two co-ordinate planes are parabolic and whose sections parallel to the third plane are either elliptical or hyperbolic.

61. Power

The rate at which electrical energy is fed into or taken from a device or system, expressed in watts or dBW. The signal strength on the uplink or downlink of a satellite communications system is quantified by the power of the radio wave radiated by the transmit antenna.

62. Power Flux Density

The signal power received over a surface area of one square metre, expressed in dBW/m<sup>2</sup>. Used to quantify the strength of a radio wave at the reception point of an earth-space link.

63. Pre-Emphasis

An artificial increase in the amplitude of the higher frequency portions of a baseband signal prior to frequency modulation and transmission via a radio link. Used in conjunction with the proper amount of de-emphasis at the receiver, this results in an improved signal-to-noise ratio for the demodulated FM signal.

64. Progressive Scanning

The process of scanning a single image ("frame") of a moving picture sequence progressively from top to bottom, producing a scanned image containing all of the horizontal lines used in the scanning process. Used in PC monitors and some advanced television systems.

65. Propagation

To transmit in the form of a wave.

66. Radiation

The outward flow of energy from any source in the form of radio waves.

67. Radio

The use of electromagnetic waves, lying in the radio frequency range, for communications purposes.

68. Radiocommunication  
Telecommunication by means of radio waves.
69. Radio-Frequency Links  
Communication links established by means of radio waves.
70. Radio Waves  
Electromagnetic waves lying in the radio frequency range, propagated in space without artificial guide.
71. RF  
Radio Frequency. The 10 kHz to 300 GHz frequency range that can be used for wireless communication. The term RF is usually used to distinguish signals transmitted to and from the satellite from signals processed at other frequencies within the same communication system (e.g. intermediate frequencies).
72. RGB  
Red Green Blue. Primary colours that, when suitably combined, produce the same visual effect as almost any other colour. These primary colours are used in colour television systems, which reproduce colour images by controlling the intensity of red, green and blue light sources on the television screen.
73. Scanning  
The process of moving the electron beam in a television camera tube simultaneously in the horizontal and vertical directions so that an image is scanned from left to right and top to bottom. The electrical signal generated by this process is converted into an image on the television screen using the same scanning sequence.
74. Scrambling  
A process that renders a signal unintelligible and/or randomises its content. It is used either to protect the content of the signal from unauthorised access, or for Energy Dispersal purposes.
75. Sparklies (Television)  
The visual effect of impulsive noise arising at the output of an FM demodulator due to a weak signal, slight mistuning of the receiver or interference. The noise appears as randomly-distributed, momentary black and white flecks on the picture.
76. Subcarrier  
Any signal carrying information that is transmitted within the bandwidth of another signal which itself modulates a carrier. Used in analogue TV transmission systems, for example, to convey colour and audio information.
77. TDM  
Time Division Multiplexing. A system in which the bits of more than one digital signal are interleaved in time to form a single digital bit stream that carries all of the information contained in the original signals.

**78. TDMA**

Time Division Multiple Access. A method allowing multiple carriers to share a single satellite transponder or range of frequencies. The earth stations transmit sequentially in unique time slots at the same carrier frequency, so that only a single station transmits at any given time.

**79. Telecommunications**

The science and technology of communication by artificial means (radio, television, telephony, etc.).

**80. Terrestrial Interference**

Interference between a satellite system and entirely earth-based microwave communication systems.

**81. UHF**

Ultrahigh Frequency. The frequency range from 300 MHz to 3 GHz.

**82. Upconversion**

The process of converting the frequency of a signal to a higher intermediate frequency or to the transmission frequency. Upconversion is performed at the transmission point to prepare the signal for transmission over the satellite link.

**83. VHF**

Very High Frequency. The frequency range from 30 MHz to 300 MHz.

**84. Videocrypt**

Proprietary conditional access system.

**85. Videoguard**

Proprietary conditional access system.

**86. Widescreen**

A television picture or television screen that is wider than a conventional (4 by 3) television picture or screen, usually with an aspect ratio of 16 by 9.

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## IGUALDAD DE GÉNERO

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