Access to Masters Offline Module

# MSc Telecommunications Engineering

Use this worksheet to rate your abilities to find out if this Masters programme is suitable for you.

# Instructions

1. Graph 1 is the profile of a student who is suited to this subject.
2. Circle the statement that you feel best represents you on each of the 12 abilities below.
3. Plot your profile on Graph 2 and compare this with the suitable entry profile.
4. If your scores fall below the suitable entry profile, access the learning materials embedded in this document.
5. After working through the learning materials repeat steps 1 and 2 and compare your profile with the suitable entry profile.
6. If it is a match then you should apply for a place on the programme.



Suitable Profile

Your Profile

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| Ability 1 Linear Algebra |

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| Ability 1 Probability, random variables and random signals |
| Ability StatementI would like to characterize my knowledge, understanding, skills, abilities, judgement and approach about probability, random variables and random signals: | **0** | I have no understanding or knowledge of this ability. I do not know anything about statistics. |
| **1** | I know the concept of **probability**. I can distinguish, from the point of view of statistic, among random experiments, and events. I don't know how to characterize the results of experiments, or calculate probabilities. |
| **2** | I know the concept of **random variable**. I can distinguish between continuous and discrete random variables. I know how to characterize random variables, with the probability density function and the distribution function. I can calculate probabilities of events with the probability density function, for both, continuous and discrete random variables. |
| **3** | I can use the **probability density function** to calculate statistics from random variables. I know the relationship between distribution function and probability density function. I know how to characterize sets of random variables with the joint probability density function. I know the concept of independence, and correlation between random variables. I know the concept of function of random variables, that determines a new random variable, and know how to obtain the probability density function of the result of a function of random variables, in some useful cases.  |
| **4** | I know what is a **random signal or stochastic process**. I know it is a function of at least one random variable and one deterministic variable. I know the properties of stationary random signals. I know the relationship between autocorrelation function and power spectral density of stationary random signals. I know the concept of ergodicity, and the relationship between ergodicity and stationarity.  |
| **5** | I have some knowledge of the **estimation theory**. I can estimate deterministic parameters of probability density functions with the maximum likelihood estimator. I can estimate random parameters and random samples with bayessian methods. I can design linear estimators of random signals.  |

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| Ability 2 Programming in high-level languages: |
| Ability StatementI would like to characterize my knowledge, understanding, skills, abilities, judgement and approach to programming in high-level languages: | **0** | I do not know to create a program for a processor. |
| **1** | I only know that a high-level programming language is a language to create programs for computers, frequently used by engineers. I know the name of some high-level programming languages, such as Pascal, Fortran, or C. |
| **2** | I can write and compile a basic programme in a high-level programming language (like C), debug errors and then run it, using a computer under Windows or Unix/Linux operating systems. I know about the main() function, directives to manage libraries of functions or toolboxes (for example, the  #include directive in C), the use of variables and constants of different types, and the most important operators in a high-level programming language. I can print on the screen and read data from the keyboard. I know the main control sentences (if, switch, while, for), and how to create "functions". I can use "arrays" of one dimension or several dimensions. I know how to use structures (variables of type "struct" in the C programming language). |
| **3** | I can create programmes that use pointers to memory. I can use pointers to pass input arguments "by reference" to the functions. I can pass arrays as input arguments to functions using pointers. I can use arrays of pointers, pointers to pointers and pointers to structures. |
| **4** | I can write programmes that accept and manipulate arguments from the command line. I know how to create new memory variables or arrays using "dynamic memory allocation". I know how to use recursivity. |
| **5** | I can create programs that manipulate files of any type on disk, and that store data in memory using dynamic structures such as stacks, queues, linked lists and binary trees, controlled by pointers. |

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| Ability 3 Signals and linear and time invariant systems, in the field of telecommunication engineering: |
| Ability StatementI would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in the characterization of signals and linear and time invariant systems, in the field of telecommunication engineering: | **0** | I do not what is the concept of a signal or a system in the Telecommunications context. |
| **1** | I just know the concept of signal, as function representing a physical magnitude, and system, which is the object that modifies signals.  |
| **2** | I know there are continuous time signals and discrete time signals. Similarly, with continuous time systems, and discrete time systems. I know the properties of signals commonly used to decompose continuous and discrete time signals: delta functions, unit step, complex exponentials and sinusoides. I know what is a linear system, a time-invariant system, and the concept of causality, stability and memory. |
| **3** | I can characterize linear and time-invariant systems in the time domain with the impulse response, using it to obtain the output of a system to an input signal through convolution. I can calculate the output of a linear and time invariant system to some simple inputs with the convolution integral or sum (depending if it is a continuous time system or discrete time system, respectively). |
| **4** | I know mathematical tools to characterize signals and systems in transform domains (Laplace and Fourier transforms for continuous time signals and systems, and Z and Fourier domains for discrete time signals and systems), and how signals are processed in the frequency domain. I know the main properties of these transforms, and the utility to obtain information form signals. I know how to obtain discrete time signals from continuous time signals.  |
| **5** | I know the relationship between time and transforms domains, the relationship between Fourier and Laplace domains, or Fourier and Z domains for discrete time signals and systems, and how continuous time systems can be simulated with discrete time systems.  |

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| Ability 4 Communication systems, the way to transmit multiples sources of information |
| Ability StatementI would like to characterize my knowledge about communication systems, the way to transmit multiples sources of information, both analogue and digital, through a channel, the quality parameters of analogue and digital communication systems, and how to calculate them: | **0** | I know nothing about communication theory. |
| **1** | I have a general idea of the meaning of “Communication Systems”, and the main constituting blocks. I know more or less, the difference between analogue and digital communication systems. |
| **2** | I just know how the main analogue modulation techniques (AM and FM), but I didn’t study digital modulations before, nor detection theory. I know the influence of noise in analogue communications, and the meaning of the Signal to Noise Ratio. |
| **3** | I know analogue modulation techniques, and I have knowledge about transmission of digital signals in the base band. I know the main problems related to the influence of the impulse response of the channel in the transmission of digital information. |
| **4** | Additionally to the previous knowledge, I also have knowledge about passband digital modulations (ASK, PSK, FSK), and about the influence of noise power in detection error, and the undesired effects due to the channel frequency response. I can design detectors for base band and pass band digital communication systems. I know the concept of constellation in digital communications, and the dependence of the probability of error on the distance of the signal vectors. I know the meaning of matched filter, and its utility in the detection of signals in digital communications with additive White Gaussian noise. |
| **5** | I know analogue modulation techniques and their utility. I have studied and understand baseband and passband digital modulations. I know what is a constellation of signal vectors, and the relationship of the noise power and distances among signal vectors, to the probability of error. I can design detectors based on the vector representation of transmitted signals, and can calculate the probability of error when the noise is additive, white and Gaussian. |

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| Ability 5 Concepts of electromagnetic fields and waves in communication systems: |
| Ability StatementI would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in concepts of electromagnetic fields and waves in communication systems: | **0** | I know nothing about waves propagation. |
| **1** | I only have knowledge about circuit analysis in low frequency, based on the Kirchhoff’s laws, and I don’t know the phenomenon of electromagnetic waves propagation.  |
| **2** | I know Maxwell’s equations and their solutions for uniform plane waves.  |
| **3** | I know and understand the mechanism of voltage and current waves propagation in transmission lines. I am also able of using black box models of antennas, and I can model the basic mechanism of electromagnetic waves propagation between elevated antennas.  |
| **4** | I understand the propagation modes in transmission lines and waveguides, the basic radiation mechanism of antennas, and the models of waves propagation including reflexion and diffraction phenomena. I am familiar with the basic antenna types, such as monopoles and dipoles. |
| **5** | I have a global and deep knowledge of transmission media, guided and unguided, being able of modelling the propagation of electromagnetic fields in both cases, and of characterizing the antenna, both in transmission and reception. I have experience in design aspects, software tools combining electromagnetics and CAD utilities. |

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| Ability 6 Application of analog circuits analysis and design, and basic concepts on analog-to-digital and digital-to-analog conversión |
| Ability StatementI would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in application of analog circuits analysis and design, and basic concepts on analog-to-digital and digital-to-analog conversión: | **0** | I do not know nothing about electronics but the existence of digital systems like PCs and so on. |
| **1** | I know there are electronic components that can be used to design analog subsystems, and the basic concept of what is an amplifier. |
| **2** | I know the model of diodes and transistors in their different working conditions. I can use the models to analyse and design single stage amplifiers in small signal and middle frequency conditions. I have some knowledge on the applications of operational amplifiers. I can describe the elements of a data acquisition system, and different alternatives for analog to digital and digital to analog conversion. |
| **3** | I know how to analyze and adjust multistage amplifiers in more realistic conditions: considering the frequency response of the amplifiers, and their behaviour in large signal conditions. I can apply feedback analysis techniques to improve the characteristics of a given amplifier. I know other alternatives to control energy transfer: integrated linear amplifiers and power supplies.  |
| **4** | I can analyse and design multi-stage amplifiers from a set of general specifications on their characteristics, by using the adequate models and strategies. I can use simulation tools to aid in the design of the amplifiers, both in the temporal and frequency domains. I can select the most adequate devices considering their general specifications.  |
| **5** | I have a deep knowledge about the design of multistage amplifiers. I can exploit the main factors with a significant effect on the capabilities of the amplifiers in terms of frequency response, robust behaviour and power consumption. I know the types of analog devices in the market and can select the most appropriate for the application. I can select the suitable integrated circuits for a particular design considering their electrical contraints, and I am able to modify the design to satisfy such constraints.  |

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| Ability 7 digital electronics and its applications: |
| Ability StatementI would like to characterize my knowledge, understanding, skills, abilities, judgement and approach of digital electronics and its applications: | **0** | I do not know what is digital electronics. |
| **1** | I just know there are fundamental principles, like Boole’s algebra, that are used for analysing digital circuits, mainly based on logic gates. |
| **2** | I know the fundamental logic functions (AND, OR, NAND, NOR, XNOR, NOT) and I identify without any problem their truth tables. I know how to use the Karnaugh map for simplifying Boolean functions. I can analyse and design simple digital electronic circuits based on the basic logic functions. |
| **3** | I know the difference between combinational and sequential digital circuits. I know how to design logic functions circuits by using logic gates and standard combinational circuits (encoder, decoder, multiplexer, demultiplexer, comparator, etc.).  |
| **4** | I have a great knowledge about signed binary arithmetic, including the use of two’s complement. I can analyse and design sequential circuits based on flip flops, counters and registers, and I know what a finite-state machine (FSM) is and its advantages when used designing sequential functions. I know that for designing digital electronic circuits there are electrical and timing considerations that should be taken into account. |
| **5** | I understand that a microprocessor is a sequential circuit that can be programmed by using instructions. I know how the arithmetic logic unit (ALU) and the instruction decoder work and how the microprocessor gets and provides the information by using the data and address buses. I know that the minimum microprocessor-based system requires the following blocks: the microprocessor, the data and program memories (physically implemented through so-called RAM and ROM memories) and the input/output interface; and of course that everything needs to be powered, and as a sequential circuit a clock signal is mandatory.  |

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| Ability 8 digital electronics and its applications: in application of digital integrated circuits for analysing and designing microprocessor-based systems: |
| Ability StatementI would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in application of digital integrated circuits for analysing and designing microprocessor-based systems: | **0** | I just know that a microprocessor is the brain of an electronic device as a PC. |
| **1** | I have a very vague knowledge about programmable devices, such as microprocessors. |
| **2** | I have knowledge about digital electronics, and can implement combinational and sequential digital circuits. I have a good knowledge about binary arithmetic. I know that when designing digital electronic circuits there are electrical and timing considerations that should be taken into account. |
| **3** | I know a microprocessor is a sequential circuit that can be programmed by using instructions, to implement specific functions. I know how the arithmetic logic unit (ALU) and the instruction decoder work and how the microprocessor gets and provides the information by using the data and address buses. I know the minimum blocks to implement a microprocessor-based system: the microprocessor, the data and program memories and the input/output interface. I am able to make a program for a microprocessor either using machine language or high-level programming language like C language. |
| **4** | I have a deep knowledge about the design of microprocessor-based systems and I know the mechanisms for the interchange of information between the microprocessor and the external devices or peripherals, e.g. interruptions or exceptions, polling, etc. I can define a memory map for a particular use and I know how to implement it by using commercial integrated circuits. I know the types of memory chips that are available at the electronic market and which are the most appropriate for an application. I can select the suitable integrated circuits for a particular design. |
| **5** | I feel well prepared for learning how a new microprocessor works and which its noticeable features are compared to other previously studied microprocessors. |

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| Ability 9 digital electronics and its applications: concepts of network architecture, protocols and communication interfaces: |
| Ability StatementI would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in concepts of network architecture, protocols and communication interfaces: | **0** | I know nothing about protocols in networks communications. |
| **1** | I only have a weak knowledge of the TCP/IP architecture, but I don’t know too much about the network elements, switching paradigms, network architecture, telematic services and applications and data transport. |
| **2** | I know the basic concepts that are essential to understand the operation of communication networks, such as: network elements, service model, protocol, basic features of physical transmission media that set up links, and multiplexing. |
| **3** | I can identify the main hardware and software components of a network architecture. Related to hardware, I know and can distinguish the differences between end systems, access networks, the network core and the main physical media that can be used. Related to software, I know how to define and distinguish between the following concepts: layer, service, entity, interface, and protocol. |
| **4** | Furthremore, I know the main stratified architecture models used in data networks: X.200 ITU-T recommendation (OSI reference model), and the TCP-UDP / IP protocol stack used on the Internet, and I can distinguish the functions of each of their layers. I know the structure and operation of a client/server model. |
| **5** | I can analyse and interpret the main protocols of the application and transport layers of the TCP/IP architecture, with the aid of computer tools. I can calculate performance metrics and delays in data networks. |

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| Ability 10 concepts of network architecture, and the fundamentals of cryptography and network security: |
| Ability StatementI would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in concepts of network architecture, and the fundamentals of cryptography and network security: | **0** | I know nothing about networks security or architecture. |
| **1** | I know the TCP/IP general architecture, elements, and protocols at the application and transport layers. |
| **2** | I can identify and explain the protocols and data formats used at the network layer in the Internet and at the link layer in wired and wireless local area networks, along with the mechanisms used to interconnect networks. |
| **3** | I can also organize, leverage and manage IP network addressing. I can describe and apply the routing algorithms and techniques used in IP networks. I can identify and describe the different medium access control techniques, and explain the fundamentals of switched local area networks and VLANs. |
| **4** | Besides the skills previously mentioned, I can identify problems and propose basic solutions regarding cryptography and network security, and network management. |
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| Ability 11 teletraffic and the telephony network: |
| Ability Statement:I would like to characterize my knowledge, understanding, skills, abilities, judgement and approach regarding teletraffic and the telephony network: | **0** | I have a basic knowledge of probability, the Poisson process and the exponential distribution. I have some knowledge about telephony, but I don't know the architecture of the Telephone Network.  |
| **1** | I have a basic knowledge of queuing theory and teletraffic. I know the architecture and functional elements of the Telephone Network. I have a very basic knowledge about signalling.   |
| **2** | telephone network. I have some knowledge of the subscriber and network signalling standards.  |
| **3** | I am able to apply the queuing and teletraffic theories to characterise the performance of a telecommunication system. I know the architecture of the Signalling System Nº 7 (SS7). I can follow a call signalling flow sequence on the telephone network. |
| **4** | I have a thorough knowledge of the transport and switching technologies used in the telephone network. I know the main international standardisation bodies in the field of telecommunications systems including ITU-T, IETF, 3GPP, IEEE and ETSI and their corresponding scopes. I know the national regulatory agencies that operate in this field and their basic function.  |
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| Ability 12 t regulatory environment of telecommunications in Spain and the European Unión:: |
| Ability Statement:I would like to characterize my knowledge, understanding, skills, abilities, judgement and approach regarding the regulatory environment of telecommunications in Spain and the European Unión:: | **0** | I know nothing about regulation of telecommunications. |
| **1** | I only have a general knowledge about regulation of telecommunications. I know there are laws regarding telecommunication, but nothing else.  |
| **2** | I know there are laws about wide band communications, about the requirements to sell and exploit telecommunications equipment, regulations of the radioelectric space, and regulations about the telecommunication infrastructures at home, in industries and cities, but I don’t know details about them.  |
| **3** | I know details of laws about wide band communications, about the requirements to sell and exploit telecommunications equipment, regulations of the radioelectric space, and regulations about the telecommunication infrastructures at home, in industries and cities. More specifically, I know the main constraints related to telecommunication infrastructures, the share of the radioelectric spectrum, the necessity to distribute the spectrum among exploiting technologies, etc. I know where to obtain detailed information about the corresponding laws.  |
| **4** | I know the existence and behaviour of regulatory organisms in Spain, such as the National Commission of Telecommunications, the State Secretary of Telecommunications, the role of the Professional Association of Telecommunication Engineers. I know how the normative is created, and the evolution of regulation in the last years. |
| **5** | Further to the knowledge about the regulation organism in Spain, and the basic regulation of telecommunications in Spain, inspired by recommendations of the European Union, I know the existence of the International Telecommunication Union, with provides standards, and regulations, that are extensively used by national organisms, and inspire many of the regulations of telecommunications around the World. |

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| Here are the Learning resources for Telecommunications Engineering, use these to enhance your ability to be successful on this master’s programme. |  |