Access to Masters Offline Module

# MSc Industrial 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.



Your Profile

Suitable Profile

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| Ability 1 Thermodynamics, heat transfer and their basic principles |
| I would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in application of thermodynamics, heat transfer and their basic principles to the resolution of engineering problems as: | **0** | No understanding. I am not familiar with this concept, question or ability. |
| **1** | Poor. I don’t know much about thermodynamics and its basic concepts. |
| **2** | Fair. I have basic knowledge about the principles of thermodynamics and its magnitudes and processes, such as first and second law of thermodynamics, enthalpy, entropy, specific heat and latent heat. |
| **3** | Good. I can use thermodynamics and its main concepts in order to solve and perform basic operational analysis of heat transfer problems. For example, I know the first and second law of thermodynamics and I use magnitudes such as enthalpy, entropy, specific heat, latent heat, heat transfer coefficient, thermal conductivity, thermal resistance or radiation heat transfer coefficient.  |
| **4** | Very good. I can use applied thermodynamics for the calculation of the main parameters characterizing power cycles and their installations. For example, I know concepts and magnitudes such as thermal efficiency, back work ratio and specific fuel consumption. |
| **5** | Excellent. I can use applied thermodynamics for the calculation and operational analysis of power cycles, air conditioning and refrigeration plants and their installations. For example, I know concepts and magnitudes such as thermal efficiency, back work ratio, specific fuel consumption, coefficient of performance and cooling capacity. |

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| Ability 2 Fluid mechanics |
| I would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in fluid mechanics as: | **0** | No understanding. I am not familiar with this concept, question or ability. |
| **1** | Poor. I have indistinct notions about the continuum hypothesis, pressure and basic laws of hydrostatics. |
| **2** | Fair. I understand the concepts of density and pressure. I can apply Archimedes’ and Pascal’s laws, and find forces and torques on submerged bodies. I know Bernoulli’s principle, including its limitations. |
| **3** | Good. I can use the control volume approach in the diagnosis of forces, torques and energy transfers in steady flow. I understand the concepts of pressure and viscous stress, and their role in the differential equations of motion for an incompressible, Newtonian fluid. I am familiar with the notions of head loss, energy and hydraulic grade lines in pipe and channel flow analysis. |
| **4** | Very good. I am familiar with the control volume technique and the integral forms of the conservation laws. I know their differential form and some solutions for simple flows at low Reynolds numbers, as Couette or Poiseuille flows. I can analyze friction and minor head losses in ducts and channels. I know the basic parameters in boundary layer analysis, such as thickness, displacement thickness and momentum thickness in laminar and turbulent regimes. |
| **5** | Excellent. I know the integral and differential forms of the conservation laws and simple solutions for the case of incompressible, Newtonian fluid flows at low Reynolds numbers. I can incorporate the effects of compressibility in the study of simple steady flows. I am familiar with the control volume approach in the computation of forces, torques, and other parameters in steady flows. I can use the head loss concept in pipe and channel flow analysis, including pumps, and frictional and minor losses. The basic properties of laminar and turbulent boundary layers are clear to me, including the conditions for flow separation. |

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| Ability 3 Materials Science |
| I would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in materials science as: | **0** | No understanding. I am not familiar with this concept, question or ability. |
| **1** | Poor. I do not know much more than there are fundamental principles that apply to electrical circuits and machines. |
| **2** | Fair. I understand...* Electrical circuits can be classified according to their excitation in direct and alternate-current.
* The active and passive elements in a circuit.
* How to express the voltage-current response in the passive and active elements.
* The fundamental laws of the analysis of circuits (Ohm’s and Kirchhoff’s laws).
* How to calculate currents, voltages, and powers for the elements in a circuit.
* The concepts of active, reactive, and apparent power, and the power factor.
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| **3** | Good. I understand...* That phasors are complex numbers very useful for the analysis of AC circuits, and that they can be used for the understanding of three-phase systems.
* The fundamentals of three-phase generators and machines, and know how to analyze balanced three-phase circuits with configurations in star/wye and in triangle/delta.
* The power in three-phase systems and how it is measured.
* Possibly-arising unbalances in three-phase systems and I know how to analyze them.
* The Millman theorem and the transformation from triangle to star and vice versa.
 |
| **4** | Very good. I understand...* How to analyze electrical circuits in transient regime.
* First- and second-order circuits, and their featuring parameters.
* How to apply the unilateral Laplace transform to analyze transient regime.
* How to use laboratory instrumentation to measure current and voltages in electrical circuits, and specifically how to use oscilloscopes, function generators, multi-meters, three-phase generators, and so.
 |
| **5** | Excellent. I have deep knowledge in...* All the theorems of the analysis of circuits, using systematic methods (loops and nodes).
* Magnetically-coupled coils and their application to the construction of transformers, and how to analyze ideal, perfect, and real transformers.
* Quadripoles and their featuring families, so that I can analyze circuits with complex configurations of quadripoles and I perform the tests of Brune.
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| Ability 4 Electrical Circuits and Machines |
| I would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in application of fundamental principles of electrical circuits and machines: | **0** | No understanding. I am not familiar with this concept, question or ability. |
| **1** | Poor. I do not know much more than there are fundamental principles that apply to electrical circuits and machines. |
| **2** | Fair. I understand...* Electrical circuits can be classified according to their excitation in direct and alternate-current.
* The active and passive elements in a circuit.
* How to express the voltage-current response in the passive and active elements.
* The fundamental laws of the analysis of circuits (Ohm’s and Kirchhoff’s laws).
* How to calculate currents, voltages, and powers for the elements in a circuit.
* The concepts of active, reactive, and apparent power, and the power factor.
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| **3** | Good. I understand...* That phasors are complex numbers very useful for the analysis of AC circuits, and that they can be used for the understanding of three-phase systems.
* That phasors are complex numbers very useful for the analysis of AC circuits, and that they can be used for the understanding of three-phase systems.
* The power in three-phase systems and how it is measured.
* Possibly-arising unbalances in three-phase systems and I know how to analyze them.
* The Millman theorem and the transformation from triangle to star and vice versa.
 |
| **4** | Very good. I understand…* How to analyze electrical circuits in transient regime.
* First- and second-order circuits, and their featuring parameters.
* How to apply the unilateral Laplace transform to analyze transient regime.
* How to use laboratory instrumentation to measure current and voltages in electrical circuits, and specifically how to use oscilloscopes, function generators, multi-meters, three-phase generators, and so on.
 |
| **5** | Excellent. I have deep knowledge in...* All the theorems of the analysis of circuits, using systematic methods (loops and nodes).
* Magnetically-coupled coils and their application to the construction of transformers, and how to analyze ideal, perfect, and real transformers.
* Quadripoles and their featuring families, so that I can analyze circuits with complex configurations of quadripoles and I perform the tests of Brune.
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| Ability 5 Electronic Fundamentals |
| I would like to characterize my knowledge, understanding, skills and abilities about Electronic Fundamentals, which covers the analysis of electronic circuits and the specification of their functions in basic electronic systems formed by analog and or digital elements or blocks. | **0** | No understanding. I am not familiar with this concept, question or ability. |
| **1** | Poor. I do not know much more than there are electronic components that can be used to processing information or controlling electric machines. |
| **2** | Fair. I can...* Analyse basic simple circuits, both in DC and AC.
* Manage with basic analogue and digital signals: I know that digital circuits manage binary signals with logic gates and I know that an amplifier process analogue signals.
 |
| **3** | Good. Additionally to levels 1 and 2, I know...* To analyse complex circuits using impedances and transfer functions in the frequency domain.
* Basic combinational and sequential digital circuits, and how to program basic applications in programmable logic devices.
* The model of an amplifier and its main parameters (gains and impedances), and specifically the Operational Amplifier and its basic configurations.
* How to manage the concepts of bandwidth and cut-off frequencies.
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| **4** | Very good. Additionally to levels 1 to 3, I know...* How to manage electric variables in Laplace and the effects of poles and zeroes.
* The relationship between circuit responses in time and in frequency.
* The basics of semiconductor devices like MOS transistors and diodes.
* The basics of switching circuits like the CMOS inverter and its role in low-power systems.
* The structure of a digital system based on microprocessors and the role of CPUs, Memories, Timers and I/O units on them.
* How to program digital systems using modular programming languages like C or similar.
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| **5** | Excellent. Additionally to levels 1 to 4, I know...* Other semiconductor devices like BJT, IGBTs and Thyristors, and something  about switched power electronics and its applications.
* The structure and behaviour of complex digital processors.
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| Ability 6 Control Engineering |
| I would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in control engineering as: | **0** | No understanding. I am not familiar with this concept, question or ability. |
| **1** | Poor. I can understand the concepts of signals and systems, transformed domains and the complex domain. |
| **2** | Fair. I can ...* Analyse a system as a transfer function and simplify complex block diagrams by block algebra and flow graph.
* Model physical systems and convert them to transfer functions.
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| **3** | Good. I can ...* Calculate the steady state and the transient response of a system.
* Obtain and analyse a root locus, and the Bode, Nyquist and Nichols diagrams.
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| **4** | Very good. I can design and modify a system to follow some restrictions using PID regulators, using several methods as root locus design and lag-lead compensation. |
| **5** | Excellent. I can apply all above contents to...* The discretization of continuous controllers and systems.
* The mapping between s plane and z plane, and the design and/or analyse discrete-time control systems, using z transform.
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| Ability 7 Machine and Mechanisms basics |
| I would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in the use of theory of machine and mechanisms basics to solve engineering problems: | **0** | No understanding. I am not familiar with this concept, question or ability. |
| **1** | Poor. I don’t know much more than the basic theory of machines and mechanisms. |
| **2** | Fair. I can obtain the degree of freedom of simple mechanisms together with a kinematic analysis (velocity and acceleration of any point). |
| **3** | Good. I can ...* Analyse the kinematics and dynamics of typical industrial engineering mechanisms (bars mechanism, gears, clutches, brakes, couplings, bearings and cams).
* Balance (statics and dynamics) rotational systems.
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| **4** | Very good. I can ...Analyse and synthesize complex mechanical systems to transmit the motion from the motor to the final use connection. Select commercial mechanical elements. |
| **5** | Excellent. I can do all what is specified in LEVEL 4 and, I can also plan the maintenance of these mechanical systems and test novel mechanism implementations. |

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| Ability 8 Principles – strength of materials |
| I would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in the use of the principles of strength of materials as: | **0** | No understanding. I am not familiar with this concept, question or ability. |
| **1** | Poor. I do not know much more than that there is strength of materials. |
| **2** | Fair. I can describe the internal forces (normal and shearing stress) caused by external loads (axial, transverse, bending and torsion loadings). |
| **3** | Good. I can analyse structural elements (beams, transmission axes and columns) when they are loaded by axial, transverse, bending and torsion actions. |
| **4** | Very good. I can ...* Analyse, evaluate and interpret the most critical points of a structural elements (beams, transmission axes or columns) with they are loaded by axial, transverse, bending and torsion actions.
* Obtain the stress tensor together with its principal stress components.
* Understand some ductile criteria and I can apply them to design structural elements.
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| **5** | Excellent. I can ...* Analyse, evaluate and interpret the most critical points of typical engineering structures like steel and concrete rigid frames and steel trusses.
* Design simple engineering buildings by chosen normalize elements.
* Use software to analyse and design these structures.
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| Ability 9 Production and Manufacturing systems |
| I would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in the production and manufacturing systems used in industrial engineering applications as: | **0** | No understanding. I am not familiar with this concept, question or ability. |
| **1** | Poor. I do not know much more than that, there are production and manufacturing systems. |
| **2** | Fair. I can...* Describe the main parts of the different industrial production processes.
* Enunciate the main manufacturing processes by plastic deformation (hot and cold processes), chip start (turning, milling, drilling and grinding)
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| **3** | Good. I can...* Explain the main parts of the different industrial production processes.
* Analyse the main manufacturing processes by plastic deformation (hot and cold processes), chip start (turning, milling, drilling and grinding).
* Apply the different techniques of measurement, comparison with patterns and calibration in production processes.
* State the different ISO quality management systems, and total quality ones.
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| **4** | Very good. I can...* Design the main manufacturing processes by plastic deformation (hot and cold processes), chip start (turning, milling, drilling and grinding).
* Organize and implement maintaining programs and ISO quality management systems.
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| **5** | Excellent. I can ...* Implement complex industrial production processes by designing any of its main manufacturing processes.
* Organize and implement maintaining programs and ISO quality management systems.
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| Ability 10 Environmental and Sustainable Technologies  |
| I would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in the use of environmental and sustainability technologies in industrial engineering applications. | **0** | No understanding. I am not familiar with this concept, question or ability. |
| **1** | Poor. I don’t know much more than that there are environmental and sustainability technologies. |
| **2** | Fair. I can describe the different industrial contaminants of water, air, as well as the techniques for their treatment. |
| **3** | Good. Apart from the stated for level 2, I can ...* Explain the characteristics of acoustic and electromagnetic pollution derived from industrial activity.
* Calculate the industrial pollution levels in specific situations and compare them with the current legislation.
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| **4** | Very good. I can analyse and design a system to reduce the industrial pollution (water, air and acoustic and electromagnetic pollution) level in a specific situation in order to achieve the current legislation. |
| **5** | Excellent. Apart from the stated for level 4, I can implement systems to reduce the industrial pollution (water, air and acoustic and electromagnetic pollution) level in a specific situation in order to achieve the current legislation. |

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| Ability 11 Project Management |
| I would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in project management as: | **0** | No understanding. I am not familiar with this concept, question or ability. |
| **1** | Poor. I don’t know much about the basic concepts project management. |
| **2** | Fair. I have basic knowledge about project management and I can identify a quality, safety and health plan in the industrial context. |
| **3** | Good. I can ...* Evaluate and solve problems related to project management.
* Obtain, analyse and manage information from different sources in this context, included that related to the feasibility and environmental impact of an industrial project.
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| **4** | Very good. I can ...* Identify and apply the best-known tools (CPM, PERT, GANNT), through computer applications, for project scheduling in terms of time and workload
* Develop an adequate control and monitoring of a project.
 |
| **5** | Excellent. I can ...* Use different methods to evaluate economic and financial concepts (NPV, TIR and others) for the industrial projects analysis and management, which allow making decisions according to the different situations.
* Develop the documentation that exposes the project results.
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| Ability 12 Industrial Organisation |
| I would like to characterize my knowledge, understanding, skills, abilities, judgement and approach in industrial organization as: | **0** | No understanding. I am not familiar with this concept, question or ability. |
| **1** | Poor. I don’t know much about types of the more common organizational structure and process-based management. |
| **2** | Fair. I have basic knowledge about types of the more commons organizational structure and process-based management. |
| **3** | Good. I can ...* Identify the processes of an industrial organization and its interconnection.
* Interpret and apply the concepts of human resources management, supply chain, and logistics in industrial environments.
 |
| **4** | Very good. I can identify and use the input and output elements of an industrial process to apply the concepts of human resources management, supply chain, and logistics in industrial environments. |
| **5** | Excellent. I can define and use improvement actions in industrial processes. |

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