Course on "Nuclear Technology"		
Units and LO Statements		
Unit 1 – Introduction to Nuclear Power Plants (4 hours)	**Responsibility / Autonomy**	
	Autonomous background on of nuclear power around the world	
	Skills	**Knowledge**
○ The student analyses the role of the nuclear power and its main characteristics in the framework of worldwide power generation.	• Describe the role of the nuclear power in the power supply of Europe and the world. • Explain the technical characteristics that makes the nuclear power different from the other types of power generation. • Show the different areas of the nuclear industry • List the power plants in the world by type and country. • Describe the differences between the types of power plants in terms of fuel, moderator and coolant.	• The role of nuclear power in the world • Energy situation analysis in Europe • Nuclear energy costs vs other sources • The nuclear industry • Types of reactors and their distribution across the world: PWR, BWR, VVER, RBMK, HTR, Fast Reactors.
Unit 2 – Neutronics and Thermal-Hydraulics Fundamentals (4 hours)	**Responsibility / Autonomy**	
	Autonomous background on neutronics and thermal hydraulics nuclear reactor fundamentals	
	Skills	**Knowledge**
• The student analyses the interaction between neutronics and thermal-hydraulics in the nuclear reactor operation.	• Explain the reactivity control in a nuclear reactor. • Describe the interaction of the reactivity with the thermal-hydraulics. • Describe the main heat transfer mechanisms in a nuclear reactor. • Explain the different flow regimes in a nuclear reactor. • Describe the mechanisms of phase change in a nuclear reactor.	• Definition of reactivity • Reactivity control in a nuclear reactor • Thermal-hydraulics and reactivity • Conduction, convection and radiation • Two phase flow regimes • Phase change
Unit 3 – Light Water Reactors (14 hours)	**Responsibility / Autonomy**	
	Autonomous background on light water reactor technology fundamentals	
	Skills	**Knowledge**
• The student analyses the technology fundamentals of Light Water Reactors	• Describe the main differences between a PWR and a BWR in terms of operation and power cycle. • List the main components of a PWR/BWR	• PWR/BWR core and fuel • PWR/BWR coolant system • PWR/BWR fluids systems: CVCS, RHR, MFWS. • PWR/BWR safeguard systems: LPIS, HPIS, AFW,

	• Describe the main coolant system of a PWR/BWR. • Describe the fluid systems of a PWR/BWR • Explain the role of the safeguards in an accident in a PWR/BWR. • Describe the waste treatment system of a PWR/BWR. • Explain the control of a PWR/BWR. • List the instrumentation of a PWR/BWR. • Justify the need of a containment building in a PWR/BWR. • Describe the modes of operation.	CSS, CCWS, ECWS. • Waste treatment systems. • PWR/BWR instrumentation and control systems. • Containment building • Reactor operation.
Unit 4 – Introduction to Nuclear Safety (4 hours)	**Responsibility / Autonomy**	
	Autonomous background on nuclear safety fundamentals	
	Skills	**Knowledge**
• The student analyses importance of nuclear safety in a nuclear reactor in terms of fuel damage and population/environment risk.	• Define what is nuclear safety • Explain the difference between Deterministic and Probabilistic Safety Analysis • Describe a Design Basis Accident in a PWR • Explain the causes and consequences of TMI, Chernobyl and Fukushima accidents.	• Definition of nuclear safety • Deterministic and Probabilistic Safety Analysis • Design Basis Accident • Severe accident: TMI, Chernobyl, Fukushima
Unit 5 – Generation III/III+ and IV reactors (4 hours)	**Responsibility / Autonomy**	
	Autonomous background on advanced reactors technology fundamentals	
	Skills	**Knowledge**
• The student analyses the design advances of Gen. III/III+ and IV reactors in terms of safety and fuel cycle.	• Describe the differences between Generation II and Generation III/III+ reactors in terms of safety. • Describe the differences between Generation II and Generation IV reactors in terms of safety. • Explain the differences between Generation II and Generation IV reactors in terms of fuel cycle.	• Generation III/III+ reactors technology: AP1000, EPR, AES2006, ABWR, ESBWR, APWR, APR1400, Hualong One. • Generation IV reactors technology: SFR, LFR, VHTR, MSR, SCWR, ADS
Assessment criteria = to demonstrate deep understanding of a LWR nuclear reactor technology fundamentals in terms of operation and safety.		
Recommended assessment methods: Theory tests (units 1-4), individual project about a severe accident (unit 4) and group project about an advanced reactor (unit 5)		

Course applicable (in part or fully) for the following job profiles:

- Nuclear engineer
- (Non nuclear) Engineer working in the nuclear field
- Safety inspector
- NPP operator