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Revision History

Revision	Date	Author/Organisation	Description
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	23/02/2017	All partners	Feedback received on preliminary draft during kick-off meeting
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1.0 BEGINNERS CURRICULUM – 15h

Introduction to 3D printing	
<i>Learning Outcomes</i>	<ul style="list-style-type: none"> - Knowledge on 3D Printing approach and basic terminology - Understanding the advantages and limitations of 3D Printing for different applications - Knowledge on the process steps for obtaining an object using 3D Printing technology
<i>Pre-requisites</i>	- Computers and Internet skills
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Additive Manufacturing approach. 3D Printing technology definition and specific terms • 3D Printing advantages and limitations • Short history of 3D Printing • 3D Printing technology steps. Examples • 3D Printing applications fields. Examples
<i>Module Suitable for</i>	Beginners
<i>No. of hours (PPT slides)</i>	4 hours consisting of min. 25 slides

Available 3D printing technologies	
<i>Learning Outcomes</i>	<ul style="list-style-type: none"> - Knowledge on the main 3D Printing processes, their advantages and limitations - Knowledge on materials issues in 3D Printing - Knowledge on STL file format
<i>Pre-requisites</i>	<ul style="list-style-type: none"> - Knowledge on 3D Printing approach to build parts and assemblies - Knowledge on 3D Printing technology steps
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Type of 3D Printing processes: main characteristics, materials, advantages and limitations, examples • STL file format
<i>Module Suitable for</i>	Beginners
<i>No. of hours (PPT slides)</i>	3 hours consisting of min. 20 slides

3D Printing equipment	
<i>Learning Outcomes</i>	<ul style="list-style-type: none"> - Understand the difference between industrial 3D printers, desktop 3D printers and home/hobbyists 3D printers - Understand the main components of a FDM 3D printer
<i>Pre-requisites</i>	<ul style="list-style-type: none"> - Knowledge on 3D Printing approach to build parts and assemblies - Knowledge 3D Printing technology steps - Knowledge on 3D Printing types of processes

<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • RepRap Project • Fused Deposition Modelling /Fused Filament Fabrication process • FDM/FFF equipment
<i>Module Suitable for</i>	Beginners
<i>No. of hours (PPT slides)</i>	2 hours consisting of min.18 slides

Select a STL model from online repositories	
<i>Learning Outcomes</i>	- Knowledge on how to access STL models repositories on internet and download the desired model (theoretical and practical skills)
<i>Pre-requisites</i>	<ul style="list-style-type: none"> - Knowledge on 3D Printing: processes, working flow - Knowledge on STL file format - Computers and Internet skills
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Access STL files repositories such as: Thingiverse, GrabCAD, Pinshape, Yeggi, etc. • Browse the repositories and download STL file • Examples
<i>Module Suitable for</i>	Beginners
<i>No. of hours (PPT slides)</i>	3 hours consisting of min.10 slides

Obtain the physical model using services offered by 3D Printing providers	
<i>Learning Outcomes</i>	- Knowledge on how to access online service bureaus or platforms for estimating printing costs and placing orders for manufacturing the desired object (theoretical and practical skills)
<i>Pre-requisites</i>	<ul style="list-style-type: none"> - Knowledge on 3D Printing: processes, working flow, materials - Knowledge on STL file format - Computers and Internet skills
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Access 3D Printing online services providers such as: 3D Hubs, Shapeways, Sculpteo, i.Materialise, StratasysDirect, QuickParts, etc. • Upload STL model, select material, 3D Printing process, machine, etc. • Evaluate cost, delivery time and other information provided by producers/platforms • Place order • Examples
<i>Module Suitable for</i>	Beginners
<i>No. of hours (PPT slides)</i>	3 hours consisting of min.10 slides

2.0 INTERMEDIATE CURRICULUM – 25h

Introduction to 3D printing	
<i>Learning Outcomes</i>	<ul style="list-style-type: none"> - Knowledge on 3D Printing approach and basic terminology - Understanding the advantages and limitations of 3D Printing for different applications - Knowledge on the process steps for obtaining an object using 3D Printing technology
<i>Pre-requisites</i>	- Computers and Internet skills
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Additive Manufacturing approach. 3D Printing technology definition and specific terms • 3D Printing advantages and limitations • Short history of 3D Printing • 3D Printing technology steps. Examples • 3D Printing applications fields. Examples
<i>Module Suitable for</i>	Intermediate
<i>No. of hours (PPT slides)</i>	4 hours consisting of min.25 slides

Available 3D printing technologies	
<i>Learning Outcomes</i>	<ul style="list-style-type: none"> - Knowledge on the main 3D Printing processes, their advantages and limitations - Knowledge on materials issues in 3D Printing - Knowledge on STL file format
<i>Pre-requisites</i>	<ul style="list-style-type: none"> - Knowledge on 3D Printing approach to build parts and assemblies - Knowledge 3D Printing technology steps
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Type of 3D Printing processes: main characteristics, materials, advantages and limitations, examples • STL file format
<i>Module Suitable for</i>	Intermediate
<i>No. of hours (PPT slides)</i>	3 hours consisting of min.20 slides

3D Printing equipment	
<i>Learning Outcomes</i>	<ul style="list-style-type: none"> - Understand the difference between industrial 3D printers, desktop 3D printers and home/hobbyists 3D printers - Understand the main components of a FDM 3D printer
<i>Pre-requisites</i>	<ul style="list-style-type: none"> - Knowledge on 3D Printing approach to build parts and assemblies - Knowledge 3D Printing technology steps

	- Knowledge 3D Printing types of processes
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • RepRap Project • Fused Deposition Modelling /Fused Filament Fabrication process • FDM/FFF equipment
<i>Module Suitable for</i>	Intermediate
<i>No. of hours (PPT slides)</i>	2 hours consisting of min.18 slides

Select a STL model from online repositories	
<i>Learning Outcomes</i>	- Knowledge on how to access STL models repositories on internet and download the desired model (theoretical and practical skills)
<i>Pre-requisites</i>	<ul style="list-style-type: none"> - Knowledge on 3D Printing: processes, working flow - Knowledge on STL file format - Knowledge of computers and Internet skills
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Access STL files repositories such as: Thingiverse, GrabCAD, Pinshape, Yeggi, etc. • Browse the repositories and download STL file • Examples
<i>Module Suitable for</i>	Intermediate
<i>No. of hours (PPT slides)</i>	3 hours consisting of min.10 slides

Check and correct STL file using dedicated software	
<i>Learning Outcomes</i>	- Knowledge on using specific software (Netfabb Basic or Magics) for checking and correcting the STL downloaded model
<i>Pre-requisites</i>	<ul style="list-style-type: none"> - Knowledge on STL file format - Computers and Internet skills
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Download and install dedicated software for STL files errors checking and correction: Magics, Netfabb Basic • Use automated tools/commands for checking STL file • Use automated tools/commands for correcting STL file • Examples
<i>Module Suitable for</i>	Intermediate
<i>No. of hours (PPT slides)</i>	3 hours consisting of min.15 slides

Obtain the physical model using services offered by 3D Printing providers	
<i>Learning Outcomes</i>	- Knowledge on how to access online service bureaus or platforms for estimating printing costs and placing orders for manufacturing the desired object (theoretical and practical skills)
<i>Pre-requisites</i>	- Knowledge on 3D Printing: processes, working flow, materials - Knowledge on STL file format - Knowledge of computers and Internet skills
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Access 3D Printing online services providers such as: 3D Hubs, Shapeways, Sculpteo, i.Materialise, StratasysDirect, QuickParts, etc. • Upload STL model, select material, 3D Printing process, machine, etc. • Evaluate cost, delivery time and other information provided by producers/platforms • Place order • Examples
<i>Module Suitable for</i>	Intermediate
<i>No. of hours (PPT slides)</i>	3 hours consisting of min.10 slides

3D Printing an object on a low-cost filament deposition based printer	
<i>Learning Outcomes</i>	- Knowledge on 3D Printing an object using low-cost 3D printer based on filament deposition: process steps, parameters, building orientation
<i>Pre-requisites</i>	- Knowledge on 3D Printing: processes, working flow
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Basic parameters for 3D Printing process based on filament deposition (layer thickness, road width, air gap, platform temperature, extruder temperature etc.). Materials issues • Main mechanical components of a low-cost 3D printer based on filament deposition. Examples. • Understand the influence of building orientation over aspects such as: support structure position and volume, surface quality, time and cost, mechanical properties
<i>Module Suitable for</i>	Intermediate
<i>No. of hours (PPT slides)</i>	3 hours consisting of min.20 slides

3D Printing an object on a low-cost filament deposition based printer – hands on sessions	
<i>Learning Outcomes</i>	- Knowledge on setting building orientation, process parameters and build an object on a low-cost 3D printer - Knowledge on 3D printer software

<i>Pre-requisites</i>	- Knowledge on FDM process, process steps and parameters, building orientation
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Import the STL file in 3D printer software, scale and position object within building envelope, set process parameters, slice the model • Apply 3D Printing process steps for 3D printing an object • Apply post-processing operations for 3D printed objects
<i>Module Suitable for</i>	Intermediate
<i>No. of hours (PPT slides)</i>	4 hours consisting of min.25 slides

3.0 ADVANCED CURRICULUM – 40h

Introduction to 3D printing	
<i>Learning Outcomes</i>	<ul style="list-style-type: none"> - Knowledge on 3D Printing approach and basic terminology - Understanding the advantages and limitations of 3D Printing for different applications - Knowledge on the process steps for obtaining an object using 3D Printing technology
<i>Pre-requisites</i>	- Computers and Internet skills
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Additive Manufacturing approach. 3D Printing technology definition and specific terms • 3D Printing advantages and limitations • Short history of 3D Printing • 3D Printing technology steps. Examples • 3D Printing applications fields. Examples
<i>Module Suitable for</i>	Advanced
<i>No. of hours (PPT slides)</i>	4 hours consisting of min.25 slides

Available 3D printing technologies	
<i>Learning Outcomes</i>	<ul style="list-style-type: none"> - Knowledge on the main 3D Printing processes, their advantages and limitations - Knowledge on materials issues in 3D Printing - Knowledge on STL file format
<i>Pre-requisites</i>	<ul style="list-style-type: none"> - Knowledge on 3D Printing approach to build parts and assemblies - Knowledge 3D Printing technology steps
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Type of 3D Printing processes: main characteristics, materials, advantages and limitations, examples • STL file format
<i>Module Suitable for</i>	Advanced

No. of hours (PPT slides)	3 hours consisting of min.20 slides
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3D Printing equipment	
<i>Learning Outcomes</i>	<ul style="list-style-type: none"> - Understand the difference between industrial 3D printers, desktop 3D printers and home/hobbyists 3D printers - Understand the main components of a FDM 3D printer
<i>Pre-requisites</i>	<ul style="list-style-type: none"> - Knowledge on 3D Printing approach to build parts and assemblies - Knowledge 3D Printing technology steps - Knowledge 3D Printing types of processes
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • RepRap Project • Fused Deposition Modeling /Fused Filament Fabrication process • FDM/FFF equipment
<i>Module Suitable for</i>	Advanced
<i>No. of hours (PPT slides)</i>	2 hours consisting of min.18 slides

3D CAD modelling software applications	
<i>Learning Outcomes</i>	<ul style="list-style-type: none"> - Understand the basic of 3D CAD modelling - Knowledge on different free 3D CAD applications. A360 Fusion
<i>Pre-requisites</i>	Knowledge of computers and Internet skills
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Fundamentals of 3D CAD modelling • Free 3D CAD software applications • A360 Fusion software - general aspects
<i>Module Suitable for</i>	Advanced
<i>No. of hours (PPT slides)</i>	2 hours consisting of min.20 slides

3D CAD modelling using A360 Fusion	
<i>Learning Outcomes</i>	<ul style="list-style-type: none"> - Knowledge on modelling a 3D object from scratch using a 3D CAD software - Knowledge on how to generate STL files from 3D CAD software
<i>Pre-requisites</i>	<ul style="list-style-type: none"> - Fundamentals of 3D CAD modelling - A360Fusion software - general aspects
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Open or create new object, save model as STL file • Set or customize working environment (units, grids etc.) • Create 2D sketches • 3D modelling using primitives and/or commands (extrusions, revolutions etc.) for generating solids using 2D sketches • Select and manipulate 3D geometry (zoom, rotate/orbit, pan etc.)

	<ul style="list-style-type: none"> • Apply Boolean operations • Apply colour, material, textures • Apply chamfer, fillets
<i>Module Suitable for</i>	Advanced
<i>No. of hours (PPT slides)</i>	11 hours consisting of min.50 slides

Select a STL model from online repositories	
<i>Learning Outcomes</i>	- Knowledge on how to access STL models repositories on internet and download the desired model (theoretical and practical skills)
<i>Pre-requisites</i>	- Knowledge on 3D Printing: processes, working flow - Knowledge on STL file format - Computers and Internet skills
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Access STL files repositories such as: Thingiverse, GrabCAD, Pinshape, Yeggi, etc. • Browse the repositories and download STL file • Examples
<i>Module Suitable for</i>	Advanced
<i>No. of hours (PPT slides)</i>	3 hours consisting of min.10 slides

Check and correct STL file using dedicated software	
<i>Learning Outcomes</i>	- Knowledge on using specific software (Netfabb Basic or Magics) for checking and correcting the STL downloaded model (theoretical and practical skills)
<i>Pre-requisites</i>	- Knowledge on STL file format - Computers and Internet skills
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Download and install dedicated software for STL files errors checking and correction: Magics, Netfabb Basic • Use automated tools/commands for checking STL file • Use automated tools/commands for correcting STL file • Examples
<i>Module Suitable for</i>	Advanced
<i>No. of hours (PPT slides)</i>	3 hours consisting of min.15 slides

Obtain the physical model using services offered by 3D Printing providers	
<i>Learning Outcomes</i>	- Knowledge on how to access online service bureaus or platforms for estimating printing costs and placing orders for manufacturing the desired object (theoretical and practical skills)
<i>Pre-requisites</i>	- Knowledge on 3D Printing: processes, working flow, materials - Knowledge on STL file format - Knowledge of computers and Internet skills
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Access 3D Printing online services providers such as: 3D Hubs, Shapeways, Sculpteo, i.Materialise, StratasysDirect, QuickParts, etc. • Upload STL model, select material, 3D Printing process, machine, etc. • Evaluate cost, delivery time and other information provided by producers/platforms • Place order • Examples
<i>Module Suitable for</i>	Advanced
<i>No. of hours (PPT slides)</i>	3 hours consisting of min.10 slides

3D Printing an object on a low-cost filament deposition based printer	
<i>Learning Outcomes</i>	- Knowledge on 3D Printing an object using low-cost 3D printer based on filament deposition: process steps, parameters, building orientation
<i>Pre-requisites</i>	- Knowledge on 3D Printing: processes, working flow
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Basic parameters for 3D Printing process based on filament deposition (layer thickness, road width, air gap, platform temperature, extruder temperature etc.). Materials issues • Main mechanical components of a low-cost 3D printer based on filament deposition. Examples. • Understand the influence of building orientation over aspects such as: support structure position and volume, surface quality, time and cost, mechanical properties
<i>Module Suitable for</i>	Advanced
<i>No. of hours (PPT slides)</i>	3 hours consisting of min.18 slides

3D Printing an object on a low-cost filament deposition based printer – hands on sessions	
<i>Learning Outcomes</i>	- Knowledge on setting building orientation, process parameters and build an object on a low-cost 3D printer - Knowledge on 3D printer software

<i>Pre-requisites</i>	- Knowledge on FDM process, process steps and parameters, building orientation
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Import the STL file in 3D printer software, scale and position object within building envelope, set process parameters, slice the model • Apply 3D Printing process steps for 3D printing an object • Apply post-processing operations for 3D printed objects • Examples. Hands-on sessions
<i>Module Suitable for</i>	Advanced
<i>No. of hours (PPT slides)</i>	4 hours consisting of min.20 slides

Design with 3D printing in mind	
<i>Learning Outcomes</i>	<ul style="list-style-type: none"> - Knowledge on 3D printed parts' defects - Understand the influence of building orientation over parts' quality and mechanical properties - Knowledge on 3D Printing design rules for parts and assemblies
<i>Pre-requisites</i>	<ul style="list-style-type: none"> - Knowledge on FDM process and process parameters - Knowledge on 3D printer software
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Building orientation in 3D Printing • Type of defects in parts manufactured using filament deposition process (FDM) • FDM process parameters' influence over parts' quality and mechanical properties • Design rules for 3D Printing parts and assemblies • Examples
<i>Module Suitable for</i>	Advanced
<i>No. of hours (PPT slides)</i>	2 hours consisting of min.15 slides

Future of 3D printing technologies	
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • Myths and reality in 3D Printing • 3D Printing risks and regulations • 3D Printing trends and developments: new materials, new applications fields • Examples

Case studies in the industry to show the potential for boosting entrepreneurial spirit, creativity and innovation	
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none"> • 3D Printing case studies for training and education • 3D Printing case studies in architecture and art • 3D Printing case studies for the medical field • 3D Printing case studies in engineering/industry

	<ul style="list-style-type: none">• 3D Printing technology as support for innovation and creativity. Examples. Success stories.
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3DP and entrepreneurship	
<i>Sub-topics to be covered</i>	<ul style="list-style-type: none">• Examples of businesses based on 3D Printing: online platform and repositories of parts for printing, service providers, hubs, training providers etc.• Examples of start-ups• Sources of founding• Skills required for the field• Opportunities for freelancers

- End -