

ADress

F O R F U T U R E



Appendix 9:

Existing E-Learning AM Courses

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SUMMARIZED LIST OF EXISTING E-LEARNING AM COURSES

Reviewed Course Number	Partner	Platform	Link	Level of Course	Target Audience	Duration	Overall platform organization	Prerequisites and co-requisites	Assessment/ verification	Final certificate	Additional material
1	UNIBO	Coursera	https://www.coursera.org/learn/additive-manufacturing-3d-printing	Undergraduate	Un-Skilled/Non-Technical	1 - 4 Weeks - 12 Hours	Recorded lectures (videos) + readings + quiz and final assignment	Not necessary	Quiz and final assignment	Certificate upon completion	Videos
2	CEF	Learn skills	https://learn.skills-framework.eu/course/ https://learn.skills-framework.eu/course/view.php?id=5	Technical/Undergraduate, Graduate	Engineer	1Weeks- 3,5 hours (only video)	Voiced ppt lecture video, course information note,Sources, self-assessment test, separate exam registration and page for certification	Not reported	self-assessment test, feedback form,skill browsing	MOOC Exam Registration/ Certification is independent and the exam procedure is mapped onto the ISO 17024 requirements	Not reported
3	CESOL_1	UDEMY	https://www.udemy.com/course/learn-3d-printing-additive-manufacturing/ https://www.udemy.com/course/fundamentals-of-additive-manufacturing-d/learn/lecture/30902896#overview	Technical/Undergraduate	Un-Skilled/Non-Technical/Technical Persons	7h 30min	Recorded videos + supplemental material	3D objects creation and processing background is preferred but not necessary	Not reported	Certificate of completion	downloaded resources
4	CESOL_2	ASME	https://www.asme.org/learning-development/find-course/design-additive-manufacturing-metals-professional-package-1/online	Technical/Undergraduate/ Graduate	Engineering teams. Design, materials and manufacturing engineers. Business Managers	20 h	Recorded videos + supplemental material + case studies	CAD, knowledge of analysis tools and traditional manufacturing processes	Final exam	Certificate of completion	Not reported
5	CESOL_3	EAE CESOL	https://www.cesol.es/cursos/adhesivos/2023/INGENIERO-EUROPEO-DE-ADHESIVOS-EAE-2023.pdf	Graduate	Supervisors/Technical Managers	21 weeks; 480 hours (325 distance learning + 155 face-to-face classes)	Sway presentations + supplemental material	University degree in science or related; knowledge in materials suggested	3 Written exams and 1 oral exam	Certificate of completion	Handbooks and recommended articles
6	EPMA	MIT xPRO	https://learn-xpro.mit.edu/additive-manufacturing	Technical/Undergraduate	Un-Skilled/Non-Technical/Technical Persons	12 Weeks- 48 Hours	video lectures, recorded interviews with academic & industry experts	Not necessary	Peer assessment at the end of every week, Graded Assignment of 20 minutes at the end of the course	Downloadable course certificate from the student dashboard after completion of the course	browser-based edX platform that includes multimedia content presentations, three-dimensional part data, & interactive quantitative tools.
7	InfoTROI N	ASTM Center of Excellence	https://amcoe.org/ https://amcoe.org/event/8thampcc/ https://na.eventscloud.com/ereg/newreg.php?eventid=751162&PPT UPM	Technical/Undergraduate/ Graduate	Un-Skilled/Non-Technical/Technical Persons	4 Weeks - September 5 to October 3	Recorded lectures (videos) + readings + live Q&A sessions + Quiz and final assignment	Not necessary	Multiple choice exam	Digital Badge after completion	Not reported
8	UPM		PPT UPM	Msc Program	Metal AM operator, Metal AM supervisor						
9	LOT_1	Gen3D	https://gen3d.com/learning/	Technical	Un-Skilled/Non-Technical/Technical Persons	Not reported	3+ hours of video content, 54 pages of detailed course notes, 5 interactive design tutorials (Windows), Industry test cases and worked examples	Individuals with a technical background and a basic knowledge of design and manufacturing	Final test	Certificate of completion	Not reported
10	LOT_2	Futurelearn	https://www.futurelearn.com/experttracks/additive-manufacturing	Technical	Non-Technical/Technical Persons	Approx 9 weeks (3 hrs per week)	bite-sized videos, long- and short-form articles, audio, and practical activities	knowledge on additive manufacturing	Final test	Digital certificate validated by the educating organisation	Not reported
11	LOT_3	Udemy	https://www.udemy.com/course/3d-printing-with-ultimaker-cura/	Technical/Undergraduate	Non-Technical/Technical Persons	42 mins on-demand video	Recorded videos + 6 downloadable resources + quizzes	Not reported	Quiz after each lesson	Certificate of completion	Videos
12	LOT_4	Udemy	https://www.udemy.com/course/intro-to-3d-printing/	Technical/Undergraduate	Non-Technical/Technical Persons	23.5 hours on-demand video	23.5 hours on-demand video (91 lectures) + 5 articles + 1 downloadable resource	Not reported	Not reported	Certificate of completion	Videos
13	CEF_1	Future Learn	https://www.futurelearn.com/search?q=additive	Intermediate	Not reported	Approx 9 weeks, 3 hrs per week, 27 hours total	Not reported	knowledge on additive manufacturing	1 exam at the end of course	Complete each course and pass assessments	Not reported
14	CEF_2	MIT	-	Intermediate	Not reported	12 weeks with 2 weeks off / 5-7 hours per week	Recorded lectures (videos) + readings + quiz and final assignment+Forms	Not reported	Not reported	Not reported	Papers and Standards. Conferences, workshops, and professional societies.
15	CEF_3	Open Learn from Open University	https://www.open.edu/openlearn/science-maths-technology/additive-manufacturing/content-section-6	Beginner	Not reported	8 hours of study + self study	reading assignments, activities	None	None	Certificate of completion	References, further reading, glossary and acknowledgment chapters
16	CEF_4	Gebze Technical University	https://abl.gtu.edu.tr/ects/?duzey=ucuncu&modul=ders_bilgi_formu&dno=MAK%20538&bolum=109&tip=yukseklisans&dil=en#section-assessment	Not reported	Not reported	Not reported	Not reported	Not reported	Written exam, Homework assignment	Not reported	Seminar/presentation
17	CEF_5	Gen3D	https://gen3d.com/learning/	Not reported	Not reported	Not reported	3+ hours of video, 5 interactive design tutorials, course notes, industry test cases	Not reported	Not reported	Not reported	Not reported

Reviewed Course Number: 1

Section1. Overall structure of the E-learning platform and AM course			
Title of the Course/Training	Additive Manufacturing		
Language of Instruction	English		
Level of Course/Training Unit	Undergraduate		
Platform name / web site	Coursera		
Target Audience	Un-Skilled/Non-Technical		
Duration	1 - 4 Weeks - 12 Hours		
Overall platform organization	Recorded lectures (videos) + readings + quiz and final assignment		
Type of Course/Training Unit	Course 3 of 3 in the "Digital Technologies and the Future of Manufacturing Specialization"		
Objectives of the Course/Training	Introduction to Additive Manufacturing, AM Processes, and future trends		
Course/Training Content	Basic information about AM: applications and uses. Economic trade offs of AM, business context/advantages of AM. Future		
Prerequisites and co-requisites	Not necessary		
Course/Training Coordinator	M.S. Krishnan		
Assessment/verification	Quiz and final assignment		
Final certificate	Certificate upon completion		
Name of Lecturers/Trainers	M.S. Krishnan (Accenture Professor of Computer Information Systems, Professor of Technology & Operatios - University of Michigan)		
Section 2. Teaching material			
Resources			
Suggested main Text Books	Not provided text books		
Additional material	Attributions & Credits.		
Section 3. E-learning Platform & course detailed structure			
	Description		
Recorded lectures (videos)	video recorded by the instructor + slide presentation		
Intermediate tests	Graded quiz with an average of 10 questions for each module		
Assignment (homework)	The assessment is based on the Engines-R-Us case study which describes the problems an aircraft engine manufacturer is		
Tutorials	not provided		
Discussion prompt	Questions about the topics of the module		
Readings	Self-reflection questions or examples from videos on youtube		
Repository	not provided		
Section 4. Assessment Methods and Criteria			
In-Term Studies	Quantity	Description	
Intermediate tests	3	graded quiz	
Assignments	1	graded final assignment + review the peers	
Other type	0		
Projects	0		
Final test	0		
Total	4		
Section 5. ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration (Hours)	Total Work Load
Weekly Theoretical Course/Training Hours		4h 35min	4h 35min
Weekly Tutorial Hours		0	0
Reading Tasks		2h 35min	2h 35min
Material Design and Implementation		0	0
Midterm Exam and Preperation for Midterm Exam		0	0
Workshop practices		0	0
Final Exam and Preperation for Final Exam		5h	5h
Total Work Load		12h	
Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:			
No	Learning Outcomes		
1	Know basic methods and materials that are used in additive manufacturing		
2	Know 3 general applications of additive manufacturing		
3	Recognize the process trade offs of additive manufacturing		
4	Recognize the benefits of additive manufacturing over traditional manufacturing processes		
5	Explain the concept of additive manufacturing compared to subtractive manufacturing		
6	Describe how and why additive manufacturing is used in at least one industrial sector		
7	Describe at least 3 types of additive manufacturing ecosystem partners		
8	Know the 5 categories of business value from additive manufacturing		
9	Know the 6 parts of the technology implementation framework for additive manufacturing		
10	Recognize the challenges and risks of implementing additive manufacturing		
11	Recognize how future trends extend current implementations of additive manufacturing		
12	Know steps to take to prepare for future digital manufacturing opportunities.		
13	Recognize instances of future trends in real-world examples.		
Section 7. Detailed Course/Training Contents			
Lecture/module	Content	Structure of the lecture	Main teaching Material
1: What is Additive Manufacturing?	Basic information about AM: applications and uses	12 videos (between 1 and 10 min) + 6 readings + pre-course survey + 1 graded quiz (9 questions)	
2: Business context of AM	Economic trade offs of AM, business context/advantages of AM	26 videos (between 2 and 10 min) + 8 readings + 1 graded quiz (9 questions)	
3: Future trend, course summary and series conclusion	Future trends in AM, course summary and series conclusion	15 videos (between 2 and 12 min) + 2 readings + 1 graded quiz (5 questions) + 1 graded final assignment + review the peers + post-course survey	

Reviewed Course Number: 2

Section1. Overall structure of the E-learning platform and AM course			
Title of the Course/Training	ADAS/ADF TESTING AND VALIDATION ENGINEER		
Language of Instruction	English		
Level of Course/Training Unit	Technical/Undergraduate, Graduate		
Platform name / web site	https://learn.skills-framework.eu/ DRIVES Project		
Target Audience	Engineer		
Duration	1Weeks- 3,5 hours (only video)		
Overall platform organization	Voiced ppt lecture video, course information note,Sources, self-assessment test, separate exam registration and page for certification		
Type of Course/Training Unit	Standalone/module of course		
Objectives of the Course/Training	The goal of the course is to give you a short introduction about ADAS testing and validation processes.		
Course/Training Content	The training includes 4 lectures based on slides with sounds for: the aspects of the new ADAS testing and validation processes, the basic features of new simulation tools for ADAS function development, the elements of an up-to-date proving ground dedicated to CAV testing and validation, the new test protocols for autonomous driving.		
Prerequisites and co-requisities			
Course/Training Coordinator	Dr. Zsolt Szalay,Henrietta Lengyel,Bálint Tóth		
Assessment/verification	self-assessment test, feedback form,skill browsing, MOOC Exam Registration/ Certification is independent and the exam procedure is mapped onto the ISO 17024 requirements.		
Final certificate			
Name of Lecturers/Trainers	Dr. Zsolt Szalay,Henrietta Lengyel,Bálint Tóth		
Section 2. Teaching material			
Resources			
Suggested main Text Books	There are written texts prepared for each course.		
Additional material	for each lesson of the course there are audio and video ppt presentations and reading resources.		
Section 3. E-learning Platform & course detailed structure			
	Description		
Recorded lectures (videos)	for each lesson of the course there are audio and video ppt presentations and reading resources.		
Intermediate tests	There is a self-assessment test after the courses are completed, a feedback section and a separate MOOC registration for certification.		
Assignment (homework)	No homework		
Tutorials	Only dubbed		
Discussion prompt	There is a messaging section inside the system		
Readings repository	There are articles etc. to read at the end of each lesson. Not provided		
Section 4. Assessment Methods and Criteria			
In-Term Studies	Quantity	Description	
Intermediate tests			
Assignments			
Other type	1		
Projects			
Final test	1		
Total	2		
Section 5. ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration (Hours)	Total Work Load
Weekly Theoretical Course/Training Hours	The training period was determined as 1 week. The total duration of the videos of 4 lessons of 50 minutes each is 3.5 hours.		
Weekly Tutorial Hours			
Reading Tasks	Reading documents are placed at the end of each lesson.		
Material Design and Implementation	In the technically prepared presentations, photographs and diagrams were used rather than writing.		
Midterm Exam and Preperation for Midterm Exam	no		
Workshop practices	no		
Final Exam and Preperation for Final Exam	only final exam		
Total Work Load			
Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:			
No	Learning Outcomes		
1	The first unit aims to give a general overview of connected and automated driving. At the first two elements, the unit presents the motivations to develop automated vehicles and the well-known standardized SAE levels (Society of		
2	The unit aims to give an overview of simulation possibilities for automated driving. There are several commercial simulation software for automated driving, but their use is very similar. Simulation possibilities are beneficial for		
3	Laboratory tests are the topic of the third unit. In laboratory tests, one or more elements are real parts of the tested		
4	Due to the high stochasticity of traffic use cases, it is very important to test the new automated driving functions on		
Section 7. Detailed Course/Training Contents			
Lecture/module	Content	Structure of the lecture	Main teaching Material
1: title of the module	Vehicle automation overview	There is a 50-minute audio ppt video, lecture notes and reading tools.	
2: title of the module	Simulation tools	There is a 50-minute audio ppt video, lecture notes and reading tools.	
3: title of the module	Laboratory level	There is a 50-minute audio ppt video, lecture notes and reading tools.	
4: title of the module	Limited public road and public road testing	There is a 50-minute audio ppt video, lecture notes and reading tools.	

Reviewed Course Number: 3

Section1. Overall structure of the E-learning platform and AM course			
Title of the Course/Training	Learn 3D printing (Additive Manufacturing) a simplified explanation for understanding and creating 3D printed objects		
Language of Instruction	English		
Level of Course/Training Unit	Technical/Undergraduate		
Platform name / web site	Udemy		
Target Audience	Un-Skilled/Non-Technical/Technical Persons		
Duration	7h 30min		
Overall platform organization	Recorded videos + supplemental material		
Type of Course/Training Unit	Standalone		
Objectives of the Course/Training	Introduction to Additive Manufacturing, AM Processes, AM Design Perspective		
Course/Training Content	Introduction; Designing for additive manufacturing; Additive manufacturing materials; CAD design for additive manufacturing; Additive manufacturing		
Prerequisites and co-requisites	3D objects creation and processing background is preferred but not necessary		
Course/Training Coordinator	Dr. Rauf Tailony		
Assessment/verification			
Final certificate	Certificate of completion		
Name of Lecturers/Trainers	Dr. Rauf Tailony		
Section 2. Teaching material			
Resources			
Suggested main Text Books			
Additional material	19 downloaded resources		
Section 3. E-learning Platform & course detailed structure			
	Description		
Recorded lectures (videos)	video recorded by the instructor with a camera of average duration of 20 min, + ppt presentation		
Intermediate tests			
Assignment (homework)			
Tutorials			
repository			
other 1			
other 2			
other 3			
Section 4. Assessment Methods and Criteria			
In-Term Studies	Quantity	Description	
Intermediate tests			
Assignments			
Other type			
Projects			
Final test			
Total			
Section 5. ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration (Hours)	Total Work Load
Weekly Theoretical Course/Training Hours			
Weekly Tutorial Hours			
Reading Tasks			
Material Design and Implementation			
Midterm Exam and Preperation for Midterm Exam			
Workshop practices			
Final Exam and Preperation for Final Exam			
Total Work Load			Number of ECTS Credits: 120 (5)
Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:			
No	Learning Outcomes		
1	Understand the production span of additive manufacturing, from the design level to the final part		
2	Differentiating between traditional processes and additive manufacturing production.		
3	Be able to apply additive manufacturing in real-world engineering applications.		
4	Understand the basic additive manufacturing processes, and the limitations and advantages of each process.		
5	Understand the limitations and advantages of each 3D printing process.		
Section 7. Detailed Course/Training Contents			
Lecture/module	Content	Structure of the lecture	Main teaching Material
1: Introduction	Introduction to additive manufacturing; 3D printing processes review; Printing techniques synonyms; Printing techniques synonyms 2	4 videos of 20 min	
2: Designing for additive manufacturing	Design rules for additive manufacturing; Advanced FDM design; Designing for SLA 3D printing; Designing for material jetting technology; Designing for metal 3D printing; Designing for 3D printed enclosures; Designing snap-fit joints for 3D printing	7 videos of 12 - 33 min	
3: Additive manufacturing materials	FDM materials characteristics; SLA materials characteristics; SLS and material jetting materials	3 videos of 15-30 min	
4: CAD design for additive manufacturing	CAD design basics for additive manufacturing; Simulating CAD design for 3D printing; SolidWorks CAD design for 3D printing	3 videos of 20-31 min	
5: Additive manufacturing (3D printing) real lide applications	Additive manufacturing medical applications; 3D printing automotive applications	2 videos of 19-24 min	

Reviewed Course Number: 4

Section 1. Overall structure of the E-learning platform and AM course			
Title of the Course/Training	Design for Additive Manufacturing with Metals Professional Package		
Language of Instruction	English		
Level of Course/Training Unit	Technical/Undergraduate/Graduate		
Platform name / web site	ASME		
Target Audience	Engineering teams at design and manufacturing firms, as well as individuals		
Duration	20 h		
Overall platform organization	Recorded videos + supplemental material + case studies		
Type of Course/Training Unit	Standalone		
Objectives of the Course/Training	Learn key foundational knowledge to design for Additive Manufacturing (AM) with metals; Prepare for part manufacturability		
Course/Training Content	Course 1: Additive Manufacturing Manufacturability: Laser Powder Bed Fusion		
Prerequisites and co-requisites	Course participants are expected to:		
Course/Training Coordinator	Chris Wentworth		
Assessment/verification	Final exam		
Final certificate	Certificate of completion		
Name of Lecturers/Trainers	Michael Hajduk		
	Timothy W. Simpson		
	Chris Wentworth		
Section 2. Teaching material			
Resources			
Suggested main Text Books			
Additional material			
Section 3. E-learning Platform & course detailed structure			
	Description		
Recorded lectures (videos)	video recorded by the instructor with a camera of average duration of 20 min, + ppt presentation		
Intermediate tests			
Assignment (homework)			
Tutorials			
repository			
other 1			
other 2			
other 3			
Section 4. Assessment Methods and Criteria			
In-Term Studies	Quantity	Description	
Intermediate tests			
Assignments	3		
Other type			
Projects			
Final test	2		
Total	5		
Section 5. ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration (Hours)	Total Work Load
Weekly Theoretical Course/Training Hours			
Weekly Tutorial Hours			
Reading Tasks			
Material Design and Implementation			
Midterm Exam and Preperation for Midterm Exam			
Workshop practices			
Final Exam and Preperation for Final Exam			
Total Work Load			Number of ECTS Credits: 120 (5)
Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:			
No	Learning Outcomes		
1	Gain a deeper insight into ASME’s Replicate Adapt Optimize™ Framework		
2	Ensure quality of a print through the use of industry best practices		
3	Identify and leverage the additive manufacturing design techniques that are specific to the Replicate, Adapt, and Optimize use		
4	Ensure quality of a print through the use of industry best practices		
5			

Section 7. Detailed Course/Training Contents			
Lecture/module	Content	Structure of the lecture	Main teaching Material
Additive Manufacturing Manufacturability: Laser Powder Bed Fusion			
1	The L-PBF Process Chain		
2	Standard L-PBF Machines Differences in Machine Types L-PBF Machine Auxiliaries Additional Hardware		
3	Melt Pool Physics Scan Strategies Part Physics		
4	Design Rules and Limitations Support Structures Part Orientation X-Y Positioning Scan Strategy Checks		
Lecture/module	Content	Structure of the lecture	Main teaching Material
Design for Additive Manufacturing with Metals			
Module 1 – New Possibilities with Additive Manufacturing	1. Course Introduction 2. Benefits of AM 3. The Challenges of Additive Manufacturing 4. Use Cases and Applications of Additive Manufacturing		
Module 2 – Design for Additive Manufacturing and the Design Engineer	5. Additive Manufacturing and the Design Engineer 6. Design for Additive Manufacturing (DfAM) Use Cases		
Module 3 – Replicate with Additive Manufacturing	7. Why Replicate with Additive Manufacturing 8. When to Replicate?		
Module 4 – Preparing a Part for Additive Manufacturing	9. Using CAD Software to Create 3D Models 10. The Build Plan 11. The Process Plan		
Module 5 – Post Process Planning	12. Post Process Planning 13. A Case Study Analysis of Additive Manufacturing Post-Processing 14. Safety Considerations		
Module 6 – Business Considerations	15. Business Considerations 16. Improving Consistency 17. Reducing Risk & Monitoring Results		
Module 7 – Adapt for Additive Manufacturing	18. Deciding When to Adapt for Additive Manufacturing 19. Adapt for Additive Manufacturing: Techniques, Constraints, and Common Risks 20. Building a Better Business Case for Additive Manufacturing 21. Case Study: Oil and Gas Latticed Part		
Module 8 – Optimize for Additive Manufacturing	22. Introduction: Optimizing Designs for Additive Manufacturing 23. Optimize for Additive Manufacturing: Software Takes the Lead 24. Weighing the Pros and Cons of an Optimized Design 25. Optimizing Case Studies: Oil/Gas Component and Race Car Upright		
Module 9 – Preparing for Build	26. Preflight Checklist 27. Course Recap 28. Final Exam		

Lecture/module	Content	Structure of the lecture	Main teaching Material
Replicate Case Study Course			
Module 1: Introduction and Considerations	Lesson 1: Introduction Welcome to the AM211 Replicate Case Study Course Course Outcomes Course Orientation and Tips When to Replicate for Additive Manufacturing Part Chosen for Replication Lesson 2: Considerations and Challenges Considerations Why Powder Bed? Alternative AM Methods Strength and Grain Direction Advanced Manufacturing Flight Check™: 3D or Conventional? Candidate for Replication Assignment Before Printing The Printing Process		
Module 2: Process Planning to Replicate the Bracket	Lesson 3: AM Workflow for Replicate AM Workflow for Replicate Lesson 4: Acquiring the file for the bracket Acquiring the File		
Module 3: Design to Replicate the Bracket	Lesson 5: Advantages and Disadvantages to AM Advantages of Replicating with AM Disadvantages of Replicating with AM		
Module 4: Print and Post-Process	Lesson 6: Printing the Bracket Orientation Other Design Techniques Advanced Manufacturing Flight Check™: Things to Consider Before Printing Everyday Object Replicate Assignment Lesson 7: Post-Processing for the Bracket Heat Treatment and Part Removal Surface treatment Certification and Wrap-Up Final Assignment Part A and B		
Lecture/module	Content	Structure of the lecture	Main teaching Material
Adapt Case Study Course			
Module 1: Introduction and Considerations	Lesson 1: Introduction Welcome to the AM212 Adapt Case Study Course Course Outcomes Course Orientation and Tips Additive Manufacturing Flight Check™ When to Adapt for Additive Manufacturing Part Chosen for Adaptation Lesson 2: Considerations Considerations Industry Requirements Alternative Methods Review Advantages and Disadvantages to Adapting		
Module 2: Process Planning to Replicate the Bracket	Lesson 3: Introduction: Example Workflow Review Section: Acquiring the CAD file Workflow for AM Adapt		
Module 3: Design to Replicate the Bracket	Lesson 4: Introduction: Ways to Adapt the Bracket Process, Method, and Design Adapt: Overview of Design Techniques Lesson 5: Printing the Bracket		
Module 4: Print and Post-Process	Orientation Flight Check: Things to Consider Before Printing Post-Processing for the Bracket Review Adapt Assignment 1		
Module 5: Conclusion and Student Submission	Lesson 6: Conclusion/ Student Submission Adapt Assignment 2		
Lecture/module	Content	Structure of the lecture	Main teaching Material
Optimise Case Study Course			
Module 1: Introduction and Considerations	Lesson 1: Introduction · Course Introduction · Course Orientation and Tips Lesson 2: Considerations · When to Optimize? · Case Studies		
Module 2: Design and optimize	Lesson 3: Optimizing design to maximize value · Advantages and Disadvantages of Optimizing a Part · Reducing Production Time and Cost · Light Weighting, Removing Material · Improving Part Function · Coalescing Assemblies · Life Cycle Cost Analysis · Putting It All Together · Assignment 1 Lesson 4: Generative Design · Basics/Fundamentals of Generative Design · Assignments 2 and 3		

Reviewed Course Number: 5

Section1. Overall structure of the E-learning platform and AM course			
Title of the Course/Training	European Adhesive Engineer (EAE)		
Language of Instruction	Spanish		
Level of Course/Training Unit	Graduate		
Platform name / web site	CESOL		
Target Audience	Supervisors/Technical Managers of those companies that want to implement industrial quality requirements in		
Duration	21 weeks; 480 hours (325 distance learning + 155 face-to-face classes)		
Overall platform organization	Sway presentations + supplemental material		
Type of Course/Training Unit	Blended Learning		
Objectives of the Course/Training	The theoretical education given to the EAE students aims at an advanced knowledge of a field of work or study,		
Course/Training Content	Adhesion and Adhesives; Materials as Adhesives; Design and construction of adhesive joints; Durability; Bonding		
Prerequisites and co-requisites	University degree in science or related; knowledge in materials suggested		
Course/Training Coordinator	Juan Vicente Rosell and Alberto Toledo		
Assessment/verification	3 Written exams and 1 oral exam		
Final certificate	Certificate of completion		
Name of Lecturers/Trainers	Juan Vicente Rosell; Dr. Alberto Toledo; Dr. Juana Abenojar; Dr. Miguel Ángel Martínez; Alberto Sastre; Dr. Juan Carlos del Real; Dr. Sara López de Armentia; Dr. Eva Paz; Dr. Yolanda Ballesteros; Dr. Antonio Portolés; Dr. Alejandro Quesada; Dr. Carolina Álvarez; Rafael Ortiz; Pablo Hernández; Antonio Conesa; Consuelo Robles;		
Section 2. Teaching material			
Resources			
Suggested main Text Books	Cesol Documentation: European Adhesive Engineer		
Additional material	Handbooks and recommended articles in each module. For example <i>E.M. Petrie. Handbook of adhesives and</i>		
Section 3. E-learning Platform & course detailed structure			
	Description		
Recorded lectures (videos)	sway presentation + face to face lectures (using ppt or whiteboard)		
Intermediate tests	at the end of each content		
Assignment (homework)			
Tutorials repository	Permanent tutorial support through our platform. From the application itself the student can send any questions		
other 1	PDF documentation for each module		
other 2	interactive forum		
other 3	self-assessment questionnaire for each content		
Section 4. Assessment Methods and Criteria			
In-Term Studies	Quantity	Description	
Intermediate tests	8		
Assignments			
Other type	28	self-assessment questionnaire	
Projects			
Final test	4		
Total	40		
Section 5. ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration (Hours)	Total Work Load
Weekly Face-to-Face Training Hours	4	40	
Weekly Theoretical Course/Training Hours	16	20	
Weekly Tutorial Hours			
Reading Tasks			
Material Design and Implementation			
Midterm Exam and Preperation for Midterm Exam	8		
Workshop practices			
Final Exam and Preperation for Final Exam	4	8	
Total Work Load			Number of ECTS Credits: 120 (5)
Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:			
No	Learning Outcomes		
1	Advanced knowledge and critical understanding of the principles and applicability of bonding technology.		
2	Advanced problem-solving skills, including evaluation, which allow the choice of suitable technical and economic		
3	Manage bonding technology application in a high complex context.		
4	Act autonomously as the responsible person for decision making and definition of Adhesive bonding related		

Section 7. Detailed Course/Training Contents

Lecture/module	Content	Structure of the lecture	Main teaching Material	Supplemental material
ADHESION AND ADHESIVES	1.1. General introduction to adhesive technology 1.2. Adhesives & Sealants	1. Watch the Sway presentation 2. Read the corresponding documentation 3. Do the self-assessment questionnaires 4. Assist to the face-to-face lectures 5. Do the evaluation exams 6. Do the exam	Cesol EAE Documentation	Sway presentation; face to face lecture; tutor
MATERIALS AS ADHERENDS	2.1 Important Adherend Properties 2.2 Surface Pre -treatment	1. Watch the Sway presentation 2. Read the corresponding documentation 3. Do the self-assessment questionnaires 4. Assist to the face-to-face lectures 5. Do the evaluation exams 6. Do the exam	Cesol EAE Documentation	Sway presentation; face to face lecture; tutor
CONSTRUCTION AND DESIGN	3.1 Fundamentals of the Strength of Materials 3.2 Joint Design 3.3 Calculation of Stresses in Bonded Joints 3.4 Hybrid Joints	1. Watch the Sway presentation 2. Read the corresponding documentation 3. Do the self-assessment questionnaires 4. Assist to the face-to-face lectures 5. Do the evaluation exams 6. Do the exam	Cesol EAE Documentation	Sway presentation; face to face lecture; tutor
DURABILITY	4.1 Introduction 4.2 Thermal Effects on Adhesive Joints 4.3 Moisture Effects on Adhesive Joints 4.4 Electrochemical and Corrosion Effects on Adhesive Joints 4.5 Chemical Effects on Adhesive Joints 4.6 Radiation and Vacuum Effects on Adhesives in Bonded Joints 4.7 Mechanical Stress Effects on Adhesive Joints 4.8 Combined Temperature - Moisture - Mechanical Stress Effects on Adhesive Joints 4.9 Weathering and Ageing Effects on Adhesive Joints 4.10 Durability Assessment and Life Prediction for Adhesive Joints	1. Watch the Sway presentation 2. Read the corresponding documentation 3. Do the self-assessment questionnaires 4. Assist to the face-to-face lectures 5. Do the evaluation exams 6. Do the exam	Cesol EAE Documentation	Sway presentation; face to face lecture; tutor
BONDING PROCESS	5.1 Introduction to the Bonding Process 5.2 Sourcing and Storing Adhesives 5.3 Preparation and application of the Adhesives 5.4 Assembly 5.5 Bonding Pressure 5.6 Adhesive Curing 5.7 Inspection 5.8 Repair 5.9 Automation and Robotics 5.10 Factory Layout	1. Watch the Sway presentation 2. Read the corresponding documentation 3. Do the self-assessment questionnaires 4. Assist to the face-to-face lectures 5. Do the evaluation exams 6. Do the exam	Cesol EAE Documentation	Sway presentation; face to face lecture; tutor
TESTING AND ANALYSIS	6.1 Property Determination for Adhesive, Adherend or Joint 6.2 Characterisation of raw material and cured adhesive 6.3 Destructive Testing 6.4 Non Destructive Testing 6.5 Examination of Joint Fracture Surfaces and Adhesive Layer	1. Watch the Sway presentation 2. Read the corresponding documentation 3. Do the self-assessment questionnaires 4. Assist to the face-to-face lectures 5. Do the evaluation exams 6. Do the exam	Cesol EAE Documentation	Sway presentation; face to face lecture; tutor
HEALTH AND SAFETY	9.1 Health and safety with adhesives 9.2 National health and safety legislation and regulations	1. Watch the Sway presentation 2. Read the corresponding documentation 3. Do the self-assessment questionnaires 4. Assist to the face-to-face lectures 5. Do the evaluation exams 6. Do the exam	Cesol EAE Documentation	Sway presentation; face to face lecture; tutor
QUALITY MANAGEMENT	8.1 Introduction – The Adhesive Bonding Process 8.2 Raw Materials Control 8.3 Process Control 8.4 End-product Control 8.5 Available Quality Tools and Techniques 8.6 Employee Training and Certification 8.7 Company Quality Management System and Certification	1. Watch the Sway presentation 2. Read the corresponding documentation 3. Do the self-assessment questionnaires 4. Assist to the face-to-face lectures 5. Do the evaluation exams 6. Do the exam	Cesol EAE Documentation	Sway presentation; face to face lecture; tutor
MANUFACTURING CASE STUDIES	9.1 Industrial Case Studies 9.2 Group Exercises	Face-to-face lecture and group exercises		

Reviewed Course Number: 6

Section1. Overall structure of the E-learning platform and AM course			
Title of the Course/Training	ADDITIVE MANUFACTURING FOR INNOVATIVE DESIGN AND PRODUCTION		
Language of Instruction	English		
Level of Course/Training Unit	Technical/Undergraduate		
Platform name / web site	MIT xPRO (Massachusetts Institute of Technology)		
Target Audience	Un-Skilled/Non-Technical/Technical Persons		
Duration	12 Weeks- 48 Hours		
Overall platform organization	video lectures, recorded interviews with academic & industry experts, A portfolio of AM applications, The use of generative		
Type of Course/Training Unit	Standalone		
Objectives of the Course/Training	Introduction to Additive Manufacturing, AM Processes, innovative design and production		
Course/Training Content	Introduction to Additive Manufacturing, AM Processes, Applications of AM, the AM design space, data presentation and		
Prerequisites and co-requisites	Not necessary		
Course/Training Coordinator	John Hart		
Assessment/verification	Peer assessment at the end of every week, Graded Assignment of 20 minutes at the end of the course		
Final certificate	Downloadable course certificate from the student dashboard after completion of the course		
Name of Lecturers/Trainers	John Hart		
	Cem Tasan		
	Ely Sachs		
	Stefanie Mueller		
	Steve Graves		
Section 2. Teaching material			
Resources			
Suggested main Text Books	Not provided		
Additional material	The interactive, browser-based edX platform that includes multimedia content presentations, three-dimensional part data, &		
Section 3. E-learning Platform & course detailed structure			
	Description		
Recorded lectures (videos)	An in-depth series of video lectures,		
Intermediate tests			
Assignment (homework)			
Tutorials			
repository			
other 1			
other 2			
other 3			
Section 4. Assessment Methods and Criteria			
In-Term Studies	Quantity	Description	
Intermediate tests			
Assignments	11		
Other type			
Projects			
Final test	1		
Total	12		
Section 5. ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration (Hours)	Total Work Load
Weekly Theoretical Course/Training Hours			
Weekly Tutorial Hours			
Reading Tasks			
Material Design and Implementation			
Midterm Exam and Preperation for Midterm Exam			
Workshop practices			
Final Exam and Preperation for Final Exam			
Total Work Load	31	39	Number of ECTS Credits: 120 (5)
Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:			
No	Learning Outcomes		
1	The vocabulary necessary to navigate the complex landscape of AM processes, materials, and applications.		
2	The ability to quantitatively assess the value of an additively manufactured part based on its production cost and		
3	The skills necessary to design parts for AM that combine engineering intuition with computationally-driven design and		
4	The ability to identify how, when, and where additive manufacturing can create value across the entire product lifecycle,		
5	An understanding of its materials compatibility, fundamental mechanism of operation, performance metrics, and design		
Section 7. Detailed Course/Training Contents			
Lecture/module	Content	Structure of the lecture	Main teaching Material
Week 1	introduction to additive manufacturing (4 hrs)		
Week 2	additive manufacturing processes (5 hrs)		
Week 3	applications of additive manufacturing (5 hrs)		
Week 4	the am design space (5 hrs)		
Week 5	computation-driven design for am (5 hrs)		
Week 6	data representation and build preparation (2 hrs)		
Week 7	implementing dfam (4 hrs)		
Week 8	assessing the cost and value of additive manufacturing (5 hours)		
Week 9	case study (5 hrs)		
Week 10	case study (5 hrs)		
Week 11	the future of production (3 hrs)		

Reviewed Course Number: 7

Section1. Overall structure of the E-learning platform and AM course			
Title of the Course/Training	ASTM Professional Certificate Course in AM - Virtual		
Language of Instruction	English		
Level of Course/Training Unit	Technical/Undergraduate/Graduate		
Platform name / web site	ASTM Center of Excellence		
Target Audience	Un-Skilled/Non-Technical/Technical Persons		
Duration	4 Weeks - September 5 to October 3		
Overall platform organization	Recorded lectures (videos) + readings + live Q&A sessions + Quiz and final assignment		
Type of Course/Training Unit	Standalone/module of course		
Objectives of the Course/Training	Introduction to Additive Manufacturing, AM Processes, AM Design Perspective		
Course/Training Content	Gain core foundational technical knowledge covering the entire AM process chain		
Prerequisites and co-requisites	Not necessary		
Course/Training Coordinator	Dr. Nima Shamsaei/Auburn University		
Assessment/verification	Multiple choice exam		
Final certificate	Digital Badge after completion		
Name of Lecturers/Trainers	Francisco Medina, David Bourell		
	Euijin Pei, David W. Rosen		
	Tony Thornton, Louis-Philippe Lefebvre		
	Richard Leach, Olaf Diege		
	Francois Richard, Don Roth		
	Nima Shamsaei, Rachael Andrulonis/Royal Lovingfoss		
	Matthew Di Prima, David Hwang, Phillip Pontikos, Daniel Porter, Anne Talley, Douglas Wells		
Section 2. Teaching material			
Resources			
Suggested main Text Books	Not provided text books		
Additional material			
Section 3. E-learning Platform & course detailed structure			
	Description		
Recorded lectures (videos)	Video recorded by the instructor with a camera of average duration of 4 hours, + ppt presentation		
Intermediate tests	Multiple choice exam		
Assignment (homework)	not provided		
Tutorials	not provided		
repository	not provided		
Discussion prompt	1 hour of Questions and Answer sessions with the lecturer after certain modules		
Section 4. Assessment Methods and Criteria			
In-Term Studies	Quantity	Description	
Intermediate tests	not provided		
Assignments	not provided		
Other type	not provided		
Projects	not provided		
Final test	1	100 multiple questions exam for 3 hours of time, %70 success is	
Total	4		
Section 5. ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration (Hours)	Total Work Load
Weekly Theoretical Course/Training Hours		8	33
Weekly Tutorial Hours			
Reading Tasks			
Material Design and Implementation			
Midterm Exam and Preperation for Midterm Exam			
Workshop practices			
Final Exam and Preperation for Final Exam			
Total Work Load			Number of ECTS Credits:
Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:			
No	Learning Outcomes		
1	An overview of AM with descriptions of different AM process categories, process steps, materials, applications and associated terminologies		
2	Outlines key considerations for AM design, including creating and working with design files, defining requirements, criticality, and material		
3	Covers feedstock behavior and its effects on part performance, powder characterization techniques, powder handling and storage, and powder re-		
4	Provides a fundamental understanding of various post-processing methods, procedures, thermal processes, and surface finishing operations, as		
5	Provides an outline of safety considerations, including insights on risk assessment strategies such as identifying hazards, mitigation measures,		
6	Details non-destructive testing and inspection methods that can be applied to AM. Specific techniques are explained along with their benefits,		
7	Focuses on fatigue testing and characterization and addresses testing requirements applicable to AM parts. Static and dynamic test methods,		
8	Provides a general understanding on the activities necessary to qualify a process and certify a part against a set of application-based regulations.		
Section 7. Detailed Course/Training Contents			
Lecture/module	Content	Structure of the lecture	Main teaching Material
Module 1: AM Process Overview and Terminology	Provides an overview of AM with descriptions of different AM process categories, process steps, materials, applications and associated terminologies	4 hours of video	
Module 2: Design and Simulation	Outlines key considerations for AM design, including creating and working with design files, defining requirements, criticality, and material suitability, and conducting analysis and simulation	4 hours of video and 1 hour of live Q&A session including Module 1	
Module 3: Feedstock	Covers feedstock behavior and its effects on part performance, powder characterization techniques, powder handling and storage, and powder re-use strategies	4 hours of video and 1 hour of live Q&A	
Module 4: Metrology and Post-Processing	Provides a fundamental understanding of various post-processing methods, procedures, thermal processes, and surface finishing operations, as applicable to different material systems.	5 hours of video and 1 hour of live Q&A	
Module 5: AM Safety	Provides an outline of safety considerations, including insights on risk assessment strategies such as identifying hazards, mitigation measures, facility design considerations, engineering and administrative considerations, and regulatory codes applicable to AM.	4 hours of video	
Module 6: Non-Destructive Inspection	Details non-destructive testing and inspection methods that can be applied to AM. Specific techniques are explained along with their benefits, limitations, and other requirements to perform the inspection.	2 hours of video and 1 hour of live Q&A including module 5	
Module 7: Mechanical Testing	Focuses on fatigue testing and characterization and addresses testing requirements applicable to AM parts. Static and dynamic test methods, testing considerations, and interpretation of the results are the key focus areas.	3 hours of video	
Module 8: Qualification and Certification Parts 1 and 2	Provides a general understanding on the activities necessary to qualify a process and certify a part against a set of application-based regulations.	4 hours of video and 1 hour of live Q&A including module 7	

Reviewed Course Number: 9

Section1. Overall structure of the E-learning platform and AM course			
Title of the Course/Training	DESIGN FOR ADDITIVE MANUFACTURING		
Language of Instruction	English		
Level of Course/Training Unit	Technical		
Platform name / web site	Gen3D/https://gen3d.com/learning/		
Target Audience	Un-Skilled/Non-Technical/Technical Persons		
Duration	No Information		
Overall platform organization	3+ hours of video content, 54 pages of detailed course notes, 5 interactive design tutorials (Windows), Industry test cases and worked		
Type of Course/Training Unit	Standalone/module of course		
Objectives of the Course/Training	This design for additive manufacturing course provides a thorough overview of design for additive manufacturing (DFAM) fundamentals.		
Course/Training Content	Gain new skills with both video content and hands-on tutorials. Get up to speed with the latest trends in additive manufacturing such		
Prerequisites and co-requisites	Whether you are new to AM or looking to boost your existing knowledge, this design for additive manufacturing course is ideal for all		
Course/Training Coordinator			
Assessment/verification	Final test		
Final certificate	Certificate		
Name of Lecturers/Trainers			
Section 2. Teaching material			
Resources			
Suggested main Text Books	Not provided text books		
Additional material			
Section 3. E-learning Platform & course detailed structure			
		Description	
Recorded lectures (videos)			
Intermediate tests			
Assignment (homework)			
Tutorials			
repository			
other 1			
other 2			
other 3			
Section 4. Assessment Methods and Criteria			
In-Term Studies	Quantity	Description	
Intermediate tests			
Assignments			
Other type			
Projects			
Final test	1		
Total	1		
Section 5. ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration (Hours)	Total Work Load
Weekly Theoretical Course/Training Hours			
Weekly Tutorial Hours			
Reading Tasks			
Material Design and Implementation			
Midterm Exam and Preparation for Midterm Exam			
Workshop practices			
Final Exam and Preparation for Final Exam			
Total Work Load	0	0	
Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:			
No	Learning Outcomes		
1			
2			
3			
4			
Section 7. Detailed Course/Training Contents			
Lecture/module	Content	Structure of the lecture	Main teaching Material
1: Introduction to the course	Course introduction. Additive manufacturing workflow. What is design for additive manufacturing? Interactive tutorial one		
2: Design for the correct process	Overview of AM categories Additive manufacturing design guidelines AM process overview with real printed parts Large scale AM with industrial examples Interactive tutorial two		
3: Design for minimal material usage	Understanding functional surfaces Topology optimisation Lattice structure design How to minimise support structure Interactive tutorial three		
4: Design for improved functionality	Multi-scale design for additive manufacturing Mass customisation Biomimetics Generative design Interactive tutorial four		
5: Design for part consolidation	Part re-design for additive manufacturing Opportunities for part consolidation Challenges with part-consolidation Design for additive manufacturing course summary Interactive tutorial five		
Interactive design tutorials	Guided AM design examples Apply the knowledge from the course Familiarisation with AM design workflows (Windows only)		

Reviewed Course Number: 10

Section1. Overall structure of the E-learning platform and AM course			
Title of the Course/Training	Intermediate Additive Manufacturing (3D Printing) ExpertTrack		
Language of Instruction	English		
Level of Course/Training Unit	Technical		
Platform name / web site	Futurelearn/https://www.futurelearn.com/experttracks/additive-manufacturing		
Target Audience	Non-Technical/Technical Persons		
Duration	Approx 9 weeks (3 hrs per week)		
Overall platform organization	bite-sized videos, long- and short-form articles, audio, and practical activities		
Type of Course/Training Unit	Standalone/module of course		
Objectives of the Course/Training	Uncover the business opportunities of additive manufacturing. Explore how additive manufacturing supports sustainability. Delve into Laser Powder		
Course/Training Content	This ExpertTrack will take you on a deep dive into additive manufacturing to understand how it can form a business at three levels: how to adapt the		
Prerequisites and co-requisites	This ExpertTrack is designed for those with some knowledge or experience in additive manufacturing. It will be particularly useful if you have learned		
Course/Training Coordinator			
Assessment/verification	Final test		
Final certificate	Digital certificate validated by the educating organisation		
Name of Lecturers/Trainers	Jouni Partanen, Kirsi Kukko, Ilkka Poutiainen, Marika Hirvimäki, Brecht Van Hooreweder, Kopila Gurung		
Section 2. Teaching material			
Resources			
Suggested main Text Books	Not provided text books		
Additional material			
Section 3. E-learning Platform & course detailed structure			
	Description		
Recorded lectures (videos)	bite-sized videos		
Intermediate tests			
Assignment (homework)			
Tutorials			
repository			
other 1	long- and short-form articles		
other 2	audio		
other 3	practical activities		
Section 4. Assessment Methods and Criteria			
In-Term Studies	Quantity	Description	
Intermediate tests			
Assignments			
Other type			
Projects			
Final test	1		
Total	1		
Section 5. ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration (Hours)	Total Work Load
Weekly Theoretical Course/Training Hours	9	3	27h
Weekly Tutorial Hours			
Reading Tasks			
Material Design and Implementation			
Midterm Exam and Preperation for Midterm Exam			
Workshop practices			
Final Exam and Preperation for Final Exam			
Total Work Load	0	0	
Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:			
No	Learning Outcomes		
1	Explain how laser powder bed fusion (LPBF) parameters can be optimised when investigating new materials		
2	Explore how additive manufacturing can be used to develop your business		
3	Identify how different industrial areas can implement additive manufacturing in their processes		
4	Describe process parameters, environmental parameters, material parameters and part parameters that are important in laser powder bed fusion		
5	Apply your improved understanding of additive manufacturing business models		
6	Assess the benefits, capabilities and limitations of additive manufacturing, and which Design for Additive Manufacturing (DfAM) methods to use		
Section 7. Detailed Course/Training Contents			
Lecture/module	Content	Structure of the lecture	Main teaching Material
1:Business Opportunities in Additive Manufacturing	Reasons to use additive manufacturing for building your business model. Using business model canvas. Presenting your business model.	Introduction. Benfits and restrictions of additive manufacturing. Business models of additive manufacturing. Introducing our case company. Building business model canvas. Practice creating Business model canvas. What is good presentation? Practice for real. Course wrap.	
2: Additive Manufacturing in the Industry: Impact on Sustainability	Metal AM and sustainability. AM in chemical industry. Design for Additive Manufacturing.	Metal AM and sustainability. AM and Chemical Industry. AM-enabled design. Hydraulic manifolds	
3: Laser Powder Bed Fusion: Optimising LPBF Parameters	Laser powder bed fusion process. Overview of LPBF parameters. Optimization of LPBF parameters for new materials.	Laser powder bed fusion and its unique process conditions. Melt pool formation. Categories of LPBF parameters. LPBF process and environment parameters. LPBF material and part parameters. Optimization of single line tracks. Optimization of part density and residual stresses. Other optimization strategies.	

Reviewed Course Number: 11

Section1. Overall structure of the E-learning platform and AM course			
Title of the Course/Training	3D printing with Ultimaker CURA		
Language of Instruction	English		
Level of Course/Training Unit	Technical/Undergraduate		
Platform name / web site	Udemy/https://www.udemy.com/course/3d-printing-with-ultimaker-cura/		
Target Audience	Non-Technical/Technical Persons		
Duration	42 mins on-demand video		
Overall platform organization	Recorded videos + 6 downloadable resources + quizzes		
Type of Course/Training Unit	Standalone/module of course		
Objectives of the Course/Training	3D Printing Slicing Software		
Course/Training Content	This course will start with an overview about additive manufacturing and 3d printing in general.		
Prerequisites and co-requisities			
Course/Training Coordinator			
Assessment/verification	Quiz after each lesson		
Final certificate	Certificate of completion		
Name of Lecturers/Trainers	Simone Robustellini		
Section 2. Teaching material			
Resources			
Suggested main Text Books	Not provided text books		
Additional material	Videos		
Section 3. E-learning Platform & course detailed structure			
	Description		
Recorded lectures (videos)	video (ppt presentation) recorded by the insctructor of average duration of 12 min		
Intermediate tests			
Assignment (homework)			
Tutorials			
repository			
Section 4. Assessment Methods and Criteria			
In-Term Studies	Quantity	Description	
Intermediate tests			
Assigments			
Other type	3		
Projects			
Final test			
Total	3		
Section 5. ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration (Hours)	Total Work Load
Weekly Theoretical Course/Training Hours		42 min.	42 min.
Weekly Tutorial Hours			
Reading Tasks			
Material Design and Implementation			
Midterm Exam and Preperation for Midterm Exam			
Workshop practices			
Final Exam and Preperation for Final Exam			
Total Work Load	0	0	
Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:			
No	Learning Outcomes		
1			
2			
3			
4			
5			
Section 7. Detailed Course/Training Contents			
Lecture/module	Content	Structure of the lecture	Main teaching Material
1: Additive Manufacturing Fundamentals	This lesson will be an overview about the Additive Manufacturing.	video + quiz	
2: Fused Deposition Modeling	This lesson will be an overview about the FDM printing technology.	video + quiz	
3: Cura download	This lesson is about the procedure to download the program.	Video	
4: Cura install	This lesson is about the procedure to install the program.	Video	
5: Cura - Setup	This lesson is about the procedure to set up the program.	Video	
6: Cura - Basics Settings	This lesson will be an overview about print settings.	Video + quiz	
7: Cura - Advanced & Hands-On	This lesson is about some advanced features and some hands-on advices.	Video	

Reviewed Course Number: 12

Section1. Overall structure of the E-learning platform and AM course			
Title of the Course/Training	Intro To 3D Printing (FDM)		
Language of Instruction	English		
Level of Course/Training Unit	Technical/Undergraduate		
Platform name / web site	Udemy/https://www.udemy.com/course/intro-to-3d-printing/		
Target Audience	Non-Technical/Technical Persons		
Duration	23.5 hours on-demand video		
Overall platform organization	23.5 hours on-demand video (91 lectures) + 5 articles + 1 downloadable resource		
Type of Course/Training Unit	Standalone/module of course		
Objectives of the Course/Training	Introduction To FDM 3D Printing		
Course/Training Content	In this course we will start with discussing what 3D Printing FDM/FFF is. Then we will talk about what are some current technologies and features		
Prerequisites and co-requisites			
Course/Training Coordinator			
Assessment/verification			
Final certificate	Certificate of completion		
	Steven Mosbrucker		
Name of Lecturers/Trainers			
Section 2. Teaching material			
Resources			
Suggested main Text Books	Not provided text books		
Additional material	Videos		
Section 3. E-learning Platform & course detailed structure			
	Description		
Recorded lectures (videos)	video recorded by the instructor		
Intermediate tests			
Assignment (homework)			
Tutorials			
repository			
other 1			
Section 4. Assessment Methods and Criteria			
In-Term Studies	Quantity	Description	
Intermediate tests			
Assigments			
Other type			
Projects			
Final test			
Total	3		
Section 5. ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration (Hours)	Total Work Load
Weekly Theoretical Course/Training Hours		23,5 h	23,5 h
Weekly Tutorial Hours			
Reading Tasks			
Material Design and Implementation			
Midterm Exam and Preperation for Midterm Exam			
Workshop practices			
Final Exam and Preperation for Final Exam			
Total Work Load	0	23,5 h	
Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:			
No	Learning Outcomes		
1	How To Start Using Your FDM 3D Printer		
2	What 3D Printer Should You Purchase		
Section 7. Detailed Course/Training Contents			
Lecture/module	Content	Structure of the lecture	Main teaching Material
1: Introduction	What is 3D printing? Types of 3D printers available. FDM vs Resin Printers	8 videos	
2: FDM 3D printing basics	What is FDM 3D printing? FDM 3D printer strenght Vs. weakneses. Anatomy Of A FDM 3D Printer	3 videos	
3: FDM materials options	Intro to material mechanics. PLA material. ABS material. PETG Material. HIPS Material. Polycarbonate Material. Nylon Material. PEEK Material. UITEM / PEI Material. TPU Material. Composites. Material Spread Sheet	10 videos + 2 articles	
4: 3D printer features for printer selection	Introduction To Printer Features. Material Diameter. Nozzle Diameter. Hotend. Number of Extruders/Hotends. Heated Bed. Printer Volume. Type Of Bed Leveling. Parts Cooling. Bed Material. Heated Chamber. Motion Kinematic Used. Filament Drive Type (Extruder Type). Control Software And Hardware Type (Open Vs Closed Source). Filament Run Out Sensor. Interaction Interface (AKA Screens). Options to Transfer Files. Kits Vs Retail. Controller Board Type. Fume Filtering Systems. 3D Printer Market Research.	21 videos + 1 article	
5: 3D printing basics	Introduction. Looking at Slicers. Installing Cura & Setting Up Cura. First Look At Cura. Locating Models To Print & Importing Models. Cura Model Modifying Tools. Slicing Your First Parts. Layer Thickness Selection. Infill Percentage Selection. Supports. Bed Adhesion. Extruder Temperature. Bed Temperature. Print Speed. Individual Model Options. Printer Selection For This Course: Ender 3 Pro. Ender 3 Pro Specifications. Parts Of The Printer. Checking For Issues and Moving Axis. Leveling Bed. Loading Filament. Slicing Benchy In Cura For First Print On Ender 3. Starting Benchy Print On Ender 3 Pro. Finished Printed Benchy Removing From Bed. Benchy Closer Look. Slicing Benchy Wave Ender 3 Pro. Controlling Printer From Cura. Starting Print Of Benchy Wave Ender 3 Pro. Middle Look at Benchy Wave Ender 3 Pro. Benchy Wave Ender 3 Pro Print Inspection. Ender 3 Conclusion. Tronxy X5SA Intro. Tronxy X5SA Axis Move. Tronxy X5SA Changing Filament. Tronxy X5SA Bed Leveling. Slicing Benchy For Tronxy X5SA. Starting Benchy Tronxy X5SA. Finishing Benchy Tronxy X5SA. Starting Benchy Wave Tronxy X5SA. Middle Benchy Wave Tronxy X5SA. Finished Benchy Wave Tronxy X5SA. Tronxy X5SA Review. Benchy Printer Comparison. Benchy Wave Printer Comparison. Intro To 3D Printing (FDM) Conclusion. Intermediate and Advanced FDM 3D Printing Topics	44 videos + 2 articles	

Reviewed Course Number: 13

Section1. Overall structure of the E-learning platform and AM course			
Title of the Course/Training	Intermediate Additive Manufacturing (3D Printing) with cost (39\$)		
Language of Instruction	English		
Level of Course/Training Unit	Intermediate		
Platform name / web site	https://www.futurelearn.com/experttracks/additive-manufacturing		
Target Audience	A person who has ome knowledge or experience in additive manufacturing.		
Duration	Approx 9 weeks		
Overall platform organization	We cant reach this information before take the course.		
Type of Course/Training Unit			
Objectives of the Course/Training	Metal AM and sustainability,		
Course/Training Content			
Prerequisites and co-requisites	Experience required This ExpertTrack is designed for those with some knowledge or experience in		
Course/Training Coordinator			
Assessment/verification	1 exam at the end of course		
Final certificate	Complete each course and pass assessments.		
Name of Lecturers/Trainers	Ilkka Poutiainen,Marika Hirvimäki,Anna Unt		
Section 2. Teaching material			
Resources			
Suggested main Text Books	Not provided text books		
Additional material	Attributions & Credits.		
Section 3. E-learning Platform & course detailed structure			
	Description		
Recorded lectures (videos)	video recorded by the instructor + slide presentation		
Intermediate tests	Graded quiz with an average of 10 questions for each module		
Assignment (homework)	The assessment is based on the Engines-R-Us case study which describes the problems an aircraft		
Tutorials	not provided		
Discussion prompt	Questions about the topics of the module		
Readings	Self-reflection questions or examples from videos on youtube		
Repository	not provided		
Section 4. Assessment Methods and Criteria			
In-Term Studies	Quantity	Description	
Intermediate tests	3	graded quiz	
Assignments	1	graded final assignment + review the peers	
Other type	0		
Projects	0		
Final test	0		
Total	4		
Section 5. ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration (Hours)	Total Work Load
Weekly Theoretical Course/Training Hours	9	18	27
Weekly Tutorial Hours	3	3	9
Reading Tasks			
Material Design and Implementation			
Midterm Exam and Preperation for Midterm Exam			
Workshop practices			
Final Exam and Preperation for Final Exam	1		
Total Work Load		12h	
Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:			
No	Learning Outcomes		
1	Identify how different industrial areas can implement AM in their processes		
2	Assess benefits and limitations of AM in chemical industry		
3	Apply Design for Additive Manufacturing (DfAM) methods depending on the requirements of the		
4	Evaluate industrial additive manufacturing capabilities related to sustainability of		
Section 7. Detailed Course/Training Contents			
Content	Structure of the lecture	Main teaching Material	Supplemental material
Discover how different industries can benefit from additive manufacturing (AM): Traditional subtractive manufacturing methods often limit the types of geometries that can be produced. Therefore, industries have favoured parts with simple geometries to keep their costs low.			
Understand the Design for Additive Manufacturing (DfAM) process: Additive manufacturing can produce products with a much higher degree of complexity by using DfAM – a design optimisation process.			
Explore future trends in metal additive manufacturing in the chemical industry:Separation and purification processes have generated interest in various industry fields, such as chemical and process engineering. You'll explore the application of metal additive manufacturing in the industry for separation, purification, and hydraulic blocks.			

Reviewed Course Number: 14

Section1. Overall structure of the E-learning platform and AM course			
MIT			
Title of the Course/Training	AM Overview		
Language of Instruction	English		
Level of Course/Training Unit	Intermediate		
Platform name / web site			
Target Audience			
Duration	12 weeks with 2 weeks off / 5-7 hours per week		
Overall platform organization	Recorded lectures (videos) + readings + quiz and final assignment+Forms		
Type of Course/Training Unit			
Objectives of the Course/Training			
Course/Training Content			
Prerequisites and co-requisites			
Course/Training Coordinator			
Assessment/verification			
Final certificate			
Name of Lecturers/Trainers	RORY BURKE,HADEN QUINLAN,PETER BAGN ,GIORGIO OLIVIERIEL ,ADAM CAMPBELL ,MAT PIGOZZO ,GLEN DESMIER ,KATHI DOBIES ,D.J. Caruso ,CHANDAN MOZUMDER ,RASMUS DEJGAARD JENSEN ,A. JOHN HART		
Section 2. Teaching material			
Resources			
Suggested main Text Books	Not provided text books		
Additional material	Online news outlets and periodicals		
	Academic journals (most require subscription)		
	Conferences, workshops, and professional societies		
	Standards		
	ASTM Overview of Additive Manufacturing Standards America Makes and ANSI Additive Manufacturing Standardization Collaborative		
Section 3. E-learning Platform & course detailed structure			
	Description		
Recorded lectures (videos)	video recorded by the instructor with a camera of average duration of 15 min, + ppt presentation		
Intermediate tests	Concept Questions - these are colored throughout the course. Sometimes concept questions are embedded in		
Assignment (homework)	Homework about the topics of the module		
Tutorials	Questions about the topics of the module		
repository	not provided		
other 1	Self-reflection questions or examples from article		
other 2	Self-reflection questions or examples from explanatory text		
other 3	PowerPoint presentations		
Section 4. Assessment Methods and Criteria			
In-Term Studies	Quantity	Description	
Intermediate tests	1		
Assignments	1		
Other type	1		
Projects	1		
Final test	1		
Total	5		
Section 5. ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration (Hours)	Total Work Load
Weekly Theoretical Course/Training Hours	5-7 Hours		
Weekly Tutorial Hours	47,5 Hours		
Reading Tasks	9 Reading Task		
Material Design and Implementation			
Midterm Exam and Preperation for Midterm Exam	176 questions		
Workshop practices	27 homework		
Final Exam and Preperation for Final Exam			
Total Work Load			
Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:			
No	Learning Outcomes		
Introduction to Additive Manufacturing (3 hrs), Incomplete	In the first module, you will do a Pre-Assessment to form the basis of your understanding of the course material. During this time, you will become familiar with the platform and course design. Finally, you will be		
Additive Manufacturing Processes (5 hrs), Incomplete section	In this module, you will explore each of the commercial AM technologies and understand their basic working		
Applications of Additive Manufacturing (5 hrs), Incomplete	The third module of the course focuses on AM applications throughout the product lifecycle and provides both a framework for understanding the value status of AM and an approach to determining business readiness in		
The AM Design Space (5 hrs), Incomplete section	In this module, you will be introduced to each core process, explaining the principles of designing parts for AM through a series of tutorial examples and test artifacts produced at MIT.		
Data Representation and Build Preparation (2hrs), Incomplete section	This module will present the software infrastructure for AM, including how data is represented in different file format schemes and how this data is translated into machine instructions via build preparation software.		
Computation-Driven Design for AM (5 hrs), Incomplete section	In this module, you will be introduced to the software workflow for additive manufacturing, including generative design tools and build preparation software.		
Implementing Design for Additive Manufacturing (DfAM) (4	This module will present a methodology for leveraging AM's design creativity to design new parts and products.		
Assessing the Cost and Value of AM (5 hrs), Incomplete section	This module will present a model and method for assessing the cost of additive manufacturing, as well as a		
Case Study (Optional) (5 hrs), Incomplete section	In this module, you complete part of a summative case study where you apply the skill acquired during the course to solve a real-world design or strategy problem. one of three cases		
The Future of Production (3 hrs), Incomplete section	The final module of the course synthesizes the material you have learned and draws a vision for the future of manufacturing where AM is part of intelligent, automated factory systems.		

Section 7. Detailed Course/Training Contents			
Lecture/module	Content	Structure of the lecture	Main teaching Material
Get Started (25 min)	Welcome (1 min) Course Schedule (3 min) Discussion Forum (5 min) Who's Taking the Course (2 min) Who's Teaching the Course (5 min) Grading and Completion Criteria (1 min) Certificate Information and CEUs (1 min) Learning Objectives and Pedagogy (2 min) Academic Integrity and Rules of Conduct (1 min) Disclaimer (1 min)	25 min	
Introduction to Additive Manufacturing , Incomplete section	Foundations of Additive Manufacturing (5 min) Defining Additive Manufacturing (10 min) (6 Questions) The Importance of Additive Manufacturing (15 min) (6 Questions) The Additive Manufacturing Industry (25 min) (5 Questions) The Additive Manufacturing Workflow (10 min) (5 Questions) The Additive Manufacturing Technology Spectrum (15 min) (3 Questions) Emerging Trends in Additive Manufacturing (10 min) Graded Assignment (1 hr) (1 Question) Key Takeaways and Course Trajectory (5 min)	3 hours,60 min video,27 question, 1 article reading,1 homework, 2 discussions	
Additive Manufacturing Processes Incomplete section	Navigating the AM Process Spectrum (10 min) Extrusion (40 min) (5 Questions) Photopolymerization (40 min) (5 Questions) Powder Bed Fusion (60 min) (8 Questions) Material Jetting (40 min) (5 Questions) Binder Jetting (40 min) (5 Questions) Directed Energy Deposition (40 min) (6 Questions) Lamination (30 min) (6 Questions) (SUPPLEMENTARY) Comparing Process and Material Performance	40 question, 5 hours,128 min video	
Applications of Additive Manufacturing Incomplete section	Applications of Additive Manufacturing (5 min), Framing the Applications of AM (30 min) (4 Questions), Prototyping (40 min) Tooling (40 min) Performance Improvement (40 min) Mid-Module Concept Questions (20 min) (6 Questions) Production (40 min) Customization and Personalization (30 min) Spare Parts, Maintenance, and Repair (20 min) Art, Design, and Architecture (30 min) A Framework for Evaluating the Adoption of AM (30 min) Graded Assignment (1 hr) (1 Question)	11 questions, 5 hours, 89 min videos, 1 article reading, 1 homework, 17 homework videos	
The AM Design Space, Incomplete section	An Introduction to Design for AM (10 min) Envisioning the AM Design Space (15 min) Comparing Process and Material Performance (45 min) AM Design Principles and the 3DMIT Kit (15 min) The 3DMIT Design Kit: Deep Dive (1.5 hrs) (24 Questions) Lattice Structures in AM (30 min)	24 questions,5 hours , 57 min video , 1 homework	
Data Representation and Build Preparation Incomplete section	Introduction (10 min) AM File Formats (20 min) (4 Questions) AM Toolpaths (15 min) Build Preparation Software (60 min)	4 questions,2 hours ,27 min video	
Computation-Driven Design for AM Incomplete section	Introduction to AM Software and Computational Design (35 min) Principles of Computational Design for AM (30 min) Computational Design of a High-Performance Wheel (60 min) Mid-Module Concept Questions (5 min) (5 Questions) Generative Design at Autodesk (10 min) Advanced Topology Optimization for AM (15 min) Graded Assignment (1 hr 30 min) (1 Question)	6 questions, 5 hours, 47 min videos, 2 reading article, 1 homework	
Implementing Design for Additive Manufacturing (DfAM) , Incomplete section	An Integrative Approach to DfAM (40 min) Integrative Examples of DfAM in Practice (20 min) Graded Assignment (1 hr 30 min) (1 Question)	1 questions, 4 hour , 13 min video,1 homework	
(SUPPLEMENTARY) AM Process Knowledge Base, Incomplete section		307 min video,54 questions , 5 reading homework	
Assessing the Cost and Value of AM , Incomplete section	Introduction (10 min) A Cost Model of Conventional Manufacturing (20 min) Modeling the Cost of AM (1 hr 30 min) (7 Questions) Assessing the Value of AM (40 min) Cost and Value Scenarios (60 min) Graded Assignment (1 hr 30 min) (1 Question)	8 question, 66 min video,5 hour, 2 part homework	
Case Study (Optional) , Incomplete section	Case Study Overview and Instructions (10 min) Option 1: Strategy and Operations (5 hrs) (1 Question) Option 2: Generative Design of a Bracket (5 hrs) (1 Question) Option 3: Part Consolidation of a Duct (CAD Required) (5 hrs) (1 Question)	5 hours,1 case study,3 homework	
Case Study (Optional) , Incomplete section			
The Future of Production, Incomplete section	Introduction (15 min) The Growing AM Infrastructure (40 min) The Digitization of Production (45 min) Staying in Touch (10 min) Graded Assignment: Reflection (20 min) (1 Question)	1 question, 3 hours, 62 min video,3 discussions	

Reviewed Course Number: 15

Section1. Overall structure of the E-learning platform and AM course			
Title of the Course/Training		Additive Manufacturing	
Language of Instruction		English	
Level of Course/Training Unit		Beginner	
Platform name / web site		Open University	
Target Audience			
Duration		8 hours of study,	
Overall platform organization		Free sign in to the platform, enroll the course, each chapter has sub titles, each	
Type of Course/Training Unit		Free, non-accredited course	
Objectives of the Course/Training		Introduction and learning outcomes chapters explains the objectives.	
Course/Training Content		6 chapters related with the course, introduction, learning outcomes, conclusion, are the	
Prerequisites and co-requisites		None	
Course/Training Coordinator		This free course was written by Matthew Moorcroft from material by Richard Moat. It	
Assessment/verification		None	
Final certificate		After completion certificate is sent to the mail of the student.	
Name of Lecturers/Trainers		This free course was written by Matthew Moorcroft from material by Richard Moat. It was first published in July 2019.	
Section 2. Teaching material			
Resources			
Suggested main Text Books		No textbook referenced. But course material can be downloaded as word or pdf	
Additional material		References, further reading, glossary and acknowledgement chapters has source links	
Section 3. E-learning Platform & course detailed structure			
		Description	
Recorded lectures (videos)			
Intermediate tests			
Assignment (homework)			
Tutorials			
Discussion prompt			
Readings			
Repository			
Section 4. Assessment Methods and Criteria			
In-Term Studies	Quantity	Description	
Intermediate tests			
Assignments			
Other type			
Projects			
Final test			
Total			
Section 5. ECTS Allocated Based on Student Workload			
Activities	Quantity	Duration (Hours)	Total Work Load
Weekly Theoretical Course/Training Hours			
Weekly Tutorial Hours			
Reading Tasks			
Material Design and Implementation			
Midterm Exam and Preparation for Midterm Exam			
Workshop practices			
Final Exam and Preparation for Final Exam			
Total Work Load			
Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:			
No	Learning Outcomes		
1	Describe additive manufacturing and explain its advantages and disadvantages		
2	Explain the processes used in additive manufacturing for a range of materials and		
3	Understand the role of additive manufacturing in the design process and the		
4	Describe the effects of surface finish and microstructural properties on behaviour for		
5	Display an awareness of residual stresses that may occur during additive manufacturing		
Section 7. Detailed Course/Training Contents			
Content	Structure of the lecture	Main teaching Material	Supplemental material
· 1 Additive manufacturing: an overview			
· 1.1 History			
· 1.2 Why is this course not called 3D printing?			
· 2 Fundamentals of the process			
· 2.1 Making shapes and structures			
· 2.2 Why additive manufacturing?			
· 2.3 Application of additive manufacturing			
· 3 Creating a model and building an artefact			
· 3.1 Computer-aided design model			
· 3.2 Model produced by laser scanning			
· 3.3 Model produced by computer-aided design			
· 3.4 Machine positioning and control			
· 3.5 Build			
· 3.6 Final components			
· 4 Materials and techniques			
· 4.1 Polymer materials			
· 4.2 Metallic materials			
· 4.3 Other materials			
· 5 Design implications			
· 5.1 Custom parts			
· 6 Finished parts			
· 6.1 Surface finish and feature quality			
· 6.2 Microstructural properties			
· 6.3 Residual stress			

Reviewed Course Number: 15-16-17 (Comparison)

Section1. Overall structure of the E-learning platform and AM course				
	Sabancı University	Open University	DESIGN FOR ADDITIVE MANUFACTURING COURSE	Gebze Technical University
Title of the Course/Training				
Language of Instruction		English		
Level of Course/Training Unit				
Platform name / web site		https://www.open.edu/openlearn/science-maths-technology/additive-manufacturing/content-section-6	https://gen3d.com/learning/	https://abl.gtu.edu.tr/ects/?duzey=ucuncu&modul=ders_bilgi_formu&dno=MAK%20538&bolum=109&tip=yukseklisans&dil=en#section-assessment
Target Audience				
Duration		8 Hours		
Overall platform organization				
Type of Course/Training Unit				
Objectives of the Course/Training	Learn the fundamentals of Additive Manufacturing processes, their materials, design, path planning and applications of various Additive Manufacturing processes.	Introduction, Additive manufacturing: an overview, Fundamentals of the process, Creating a model and building an artefact, Materials and techniques, Design implications, Finished parts, Conclusion, References, Further reading, Glossary, Acknowledgements		This course teaches the fundamentals of Additive Manufacturing and describes various additive manufacturing processes and applications. Also covers, the abilities and common problems that are seen in AM.
Course/Training Content				
Prerequisites and co-requisites				
Course/Training Coordinator				
Assessment/verification				
Final certificate				
Name of Lecturers/Trainers	Prof. Bahattin Koc			
Section 2. Teaching material				
Resources				
Suggested main Text Books	Sabancı University	Open University	DESIGN FOR ADDITIVE MANUFACTURING COURSE	Gebze Technical University
Additional material	Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing by Ian Gibson, David W. Rosen, Brent Stucker	N/A	N/A	Gibson, I., Rosen, D. W., Stucker, B., & Khorasani, M. (2021). Additive manufacturing technologies. Cham, Switzerland: Springer.
	Fabricated: The New World of 3D Printing by Hod Lipson, Melba Kurman			
	Computer Aided Manufacturing, by T.C. Chang, R.A. Wysk, and H.P. Wang 3rd Edition, Prentice Hall, 2006.			
	Product Design: Techniques in Reverse Engineering and New Product Development by K. Otto and K. Wood, Prentice Hall, 2001.			
	Principles of CAD/CAM/CAE, by K. Lee, Addison-Wesley, 1999.			
Section 3. E-learning Platform & course detailed structure				
Description				
Recorded lectures (videos)	Sabancı University	Open University	DESIGN FOR ADDITIVE MANUFACTURING COURSE	Gebze Technical University
Intermediate tests	Assignments			
Assignment (homework)	Projects		3+ hours of video content	Written exam
Tutorials	Review Paper		5 interactive design tutorials (Windows)	Homework assignment
repository	Final Exam		54 pages of detailed course notes	Seminar/presentation
other 1			Industry test cases and worked examples	
other 2				
other 3				
Section 4. Assessment Methods and Criteria				
Quantity and Description				
In-Term Studies	Sabancı University	Open University	DESIGN FOR ADDITIVE MANUFACTURING COURSE	Gebze Technical University
Intermediate tests				
Assignments				
Other type				
Projects				
Final test				
Total	N/A	N/A	N/A	N/A

Section 6. Course/Training Learning Outcomes: Upon the successful completion of this course/training, students/attendees will be able to:

Learning Outcomes				
N.	Sabancı University	Open University	DESIGN FOR ADDITIVE MANUFACTURING COURSE	Gebze Technical University
1	Learn various Additive Manufacturing (AM) processes	N/A	1. Introduction to the course Course introduction	Demonstrate professional and ethical responsibility.
2	Understand the fundamental physical fundamentals of AM processes		2. Design for the correct process Core design principles of AM This design for additive manufacturing course provides a thorough overview of design for additive manufacturing (DfAM) fundamentals. The online course consists of 5 parts which cover the core design principles anyone getting into AM should know.	Review the literature critically pertaining to his/her research projects, and connect the earlier literature to his/her own results,
3	Analyze and optimize Computer-Aided Design (CAD) for AM			
4	Develop and implement algorithms to generate path plans for AM		3. Design for minimal material usage	Apply modern techniques, skills and equipments to advanced engineering practice
5	Decide on materials for AM			
6	Identify capabilities, constraints and limitations of AM processes to decide on best process for a given application		4. Design for improved functionality	Acquire scientific knowledge
7			5. Design for part consolidation	Define and manipulate advanced concepts of Mechanical Engineering
8			Interactive design tutorials Latest trends in additive manufacturing Gain new skills with both video content and hands-on tutorials. Get up to speed with the latest trends in additive manufacturing such as optimising parts with generative design, minimising material with lattices and simplifying assemblies with part consolidation.	Develop an awareness of continuous learning in relation with modern technology
9				Effectively express his/her research ideas and findings both orally and in writing
10				Effectively express his/her research ideas and findings both orally and in writing

Section 7. Detailed Course/Training Contents

Content				
N.	Sabancı University	Open University	DESIGN FOR ADDITIVE MANUFACTURING COURSE	Gebze Technical University
1	Introduction Additive Manufacturing	Course content	1. Introduction to the course	Week 1: Introduction to Additive Manufacturing: Evaluation from Rapid Prototyping to an Advanced Manufacturing Method
2	Computer-aided design for AM	Introduction	Additive manufacturing workflow	Week 2: Materials for AM: Polymers: Personal Printers
3	Reverse engineering	Learning outcomes	What is design for additive manufacturing?	Week 3: Materials for AM: Polymers: Industrial Polymer Printers Homework 1
4	Path Planning and optimization AM	1 Additive manufacturing: an overview 1.1 History 1.2 Why is this course not called 3D printing?	Interactive tutorial one	Week 4: Materials for AM: Metals and Ceramics: Indirect Processes
5	Different AM processes and physical fundamentals	2 Fundamentals of the process 2.1 Making shapes and structures 2.2 Why additive manufacturing? 2.3 Application of additive manufacturing	2. Design for the correct process	Week 5: Materials for AM: Metals and Ceramics: Direct Processes

6	Photopolymerization	3 Creating a model and building an artefact 3.1 Computer-aided design model 3.2 Model produced by laser scanning 3.3 Model produced by computer-aided design 3.4 Machine positioning and control 3.5 Build 3.6 Final components	Overview of AM categories	Week 6: Materials for AM: Metals and Ceramics: Direct Processes (Cont.) Homework 2
7	Powder Processes	4 Materials and techniques 4.1 Polymer materials 4.2 Metallic materials 4.3 Other materials	Additive manufacturing design guidelines	Week 7: AM of Composite Materials, Bioprinting
8	Extrusion	5 Design implications 5.1 Custom parts	Large scale AM with industrial examples	Week 8: Part Characterization for AM MIDTERM EXAM
9	Hybrid	6 Finished parts 6.1 Surface finish and feature quality 6.2 Microstructural properties 6.3 Residual stress	AM process overview with real printed parts	Week 9: Powder and Part Characterization for AM (cont.), New powders, Alloy development Homework 3
10	Materials for AM processes	Conclusion References Further reading Glossary Acknowledgements	Interactive tutorial two	Week 10: Process Maps and Process Control in AM
11	Applications of AM		3. Design for minimal material usage	Week 11: Microstructure and Porosity Control in AM
12	Tooling		Understanding functional surfaces	Week 12: Thermal Modeling of AM: Melt Pool and Temperature Distributions Homework 4
13	Advanced AM Processes		Topology optimisation	Week 13: Thermomechanical Modeling of AM: Residual Stresses and Distortions
14		Lattice structure design	Lattice structure design	Week 14: Applications of AM: Aerospace, Biomedical, Automotive, Bio-printing, Tissue & Organ Engineering, Architectural Engineering, Art, Health care. Student Presentations
15		How to minimise support structure	How to minimise support structure	
16		Interactive tutorial three	Interactive tutorial three	
17		4. Design for improved functionality	4. Design for improved functionality	
18		Multi-scale design for additive manufacturing	Multi-scale design for additive manufacturing	
19		Mass customisation	Mass customisation	
20		Biomimetics	Biomimetics	
21		Generative design	Generative design	
22		Interactive tutorial four	Interactive tutorial four	
23		5. Design for part consolidation	5. Design for part consolidation	
24		Part re-design for additive manufacturing	Part re-design for additive manufacturing	
25		Opportunities for part consolidation	Opportunities for part consolidation	
26		Challenges with part-consolidation	Challenges with part-consolidation	
27		Design for additive manufacturing course summary	Design for additive manufacturing course summary	
28		Interactive tutorial five	Interactive tutorial five	
29		Interactive design tutorials	Interactive design tutorials	
30		Guided AM design examples	Guided AM design examples	
31		Apply the knowledge from the course	Apply the knowledge from the course	
32		Familiarisation with AM design workflows	Familiarisation with AM design workflows	