



**Ahmedabad
University**

Course	ENR105 Product Dissection and Realization	Semester	Monsoon Semester 2024
Faculty Name(s)	Anamika Maurya, Hemant Chouhan, Shashi Prabh	Contact	anamika.maurya@ahduni.edu.in, hemant.chouhan@ahduni.edu.in, shashi.prabh@ahduni.edu.in
School	SEAS	Credits	2
GER Category:	GER, but not one of the above specified Categories	Teaching Pedagogy Enable: YES	P/NP Course: Can not be taken as P/NP

Schedule	Section 1	08:00 am to 09:00 am	Sat	29-07-24 to 26-11-24
		09:00 am to 10:00 am	Sat	29-07-24 to 26-11-24
		10:00 am to 11:00 am	Sat	29-07-24 to 26-11-24
		11:00 am to 12:00 pm	Sat	01-08-24 to 26-11-24
	Section 2	10:00 am to 11:00 am	Sat	29-07-24 to 26-11-24
		11:00 am to 12:00 pm	Sat	29-07-24 to 26-11-24
		12:00 pm to 01:00 pm	Sat	29-07-24 to 26-11-24
		01:00 pm to 02:00 pm	Sat	29-07-24 to 26-11-24
	Section 3	02:00 pm to 03:00 pm	Sat	29-07-24 to 26-11-24
		03:00 pm to 04:00 pm	Sat	29-07-24 to 26-11-24
		04:00 pm to 05:00 pm	Sat	29-07-24 to 26-11-24
		05:00 pm to 06:00 pm	Sat	01-08-24 to 26-11-24
Prerequisite	Not Applicable			
Antirequisite	Not Applicable			
Corequisite	Not Applicable			

Course Description	<p>This course imparts knowledge on the study of products with emphasis on generating bill of materials, part naming and numbering, their materials of construction and processes of manufacture. Aspects of mechanical, electrical, electronics, and civil engineering, amongst others, and design and ergonomics are experienced. Students practice a variety of hands-on manufacturing operations, followed by making of a multi-part, multi-process components to realize a product. Processes of manufacture include, but are not limited to machining, 3D printing, joining and welding, weaving, casting, finishing and painting, using materials, such as, mild steel, aluminium, wood, polymeric materials, concrete mixes, and fabrics, amongst others.</p>
Course Objectives	<p>The Course Educational Objectives (CEOs) are to:</p> <p>CEO1 Understand the construction, materials and functional aspects of commonly used products;</p> <p>CEO2 Learn to prepare an engineering drawing of a given part, i.e. reverse engineering;</p> <p>CEO3 Learn about materials used in making parts and their specifications;</p> <p>CEO4 Learn to disassemble and reassemble a product using appropriate hand tools;</p> <p>CEO5 Gain exposure to different machines-tools, including CNC machines, and power tools, and get hands-on training in operating them;</p> <p>CEO6 Learn about materials and manufacturing processes that can be deployed to produce an engineered part/product.</p> <p>CEO7 Be able to make manufacturing process sheet and make simple products</p>
Learning Outcomes	<p>After completing this course, a student should be able to,</p> <ul style="list-style-type: none"> • Identify and use hand-tools and power tools in a safe manner • Use machine tools, including programming of CNC machines, and 3D printers • Measure product dimensions and features to ascertain their compliance with those specified on the engineering drawing • Exercise safety and professional practices related to manufacturing • Disassemble, study functioning of parts, and reassemble a simple engineered product • Identify material of construction of a part and its possible manufacturing processes • Make a manufacturing process sheet for realizing a part from its engineering drawing/sketch for specified material

Pedagogy	The class will be divided into pairs for product dissection exercises, and in teams of four for realization. Manuals and videos about products will be made available before class. Videos of various manufacturing processes will be made available via LMS which the students have to study before coming to the workshop. Instructions for hands-on work will be available which students shall follow for executing the tasks. Team work will be emphasized in product realization where team members will make a few parts each that will be then used to assemble the product. All exercise involve hands-on working.
Expectation From Students	Required materials will be made available via LMS which the students have to study before coming to the workshop. Students have to prepare report in a specified format for the performed activities.
Assessment/Evaluation	<ul style="list-style-type: none"> • End Semester Examination: <ul style="list-style-type: none"> ◦ End semester Quiz - 15% ◦ Project - 35% • Other Components: <ul style="list-style-type: none"> ◦ Weekly Assessment - 50%
Attendance Policy	As per Ahmedabad University Policy.
Project / Assignment Details	Each assembly-disassembly (6-8 in number) is a small project type activity. The final product making is a major project activity.
Course Material	<p>Reference Book</p> <ul style="list-style-type: none"> • Product Realization: Going from One to a Million, Anna C. Thornton, Wiley, ISBN: 978-1-119-64953-3, Year: 2021, <p>Other Course Material</p> <ul style="list-style-type: none"> • Manufacturing Engineering and Technology,, Authors: S Kalpakjian and S R Schmid, Year: 2014, Publisher: Pearson Education. , • Handouts and videos prepared for the course., Online videos on various manufacturing processes (e.g. Discovery Channel "How do they do it?") , • Some Indian Standards for products.,

Additional Information

This course provides knowledge of general- and specific-purpose products through hands-on reverse engineering, and materials and their processes of manufacture. Such products involve knowledge of several disciplines covering topics from mechanical, electrical, civil, electronics, communication, consumer behaviour, sustainability, and safety, among others.

For the first 9 sessions, each 4 hour session, will have 2 hours of product dissection/reverse engineering activity and a 2 hour manufacturing demonstration and hands-on practise. The last 4 sessions will be devoted to project execution in teams of four students. Each student will be responsible for making a few components of a product. In the end, the team will assemble all the products to realize the product. Products will be selected such that they can be of use to someone, e.g. toys, games, etc.

Typical products for dissection/reverse engineering:

Hand pump, LPG stove, kerosene stove, tap, pipe valve, toaster, hard disk drive, PCB, toilet flush, umbrella, hair drier, mixie/food processor, weaving machine, sewing machine, ceiling fan, air conditioner, footwear, wheel chair, pressure cooker, bicycle, etc.

Materials that students will work will include:

Wood, Mild steel sheets and sections, aluminium foil, sheet and sections, acrylic sheet, MDF sheet, plywood, ABS, Cement-concrete, clay, cotton/polyester fibres and fabric, copper wire, wax, chocolate, clay, plaster of paris, adhesive resins,

Hands-on training will include:

Use of hand operated power tools – drill machine, circular saw, reciprocating saw, core drill machine, hammer drill, sander, buffing machine, etc.

Work on machine tools – Manual and CNC lathe, Manual and CNC milling machine, bench drill, laser cutting machine, welding and brazing, hack saw, shaper, slotter, 3D printer,

Use of hand tools – spanner, screw driver (various types), wrench, pliers (various types), mallet, hammer, chisel (different types), scissors, saw (different types)

Processes that students will learn and practice on:

Cutting, drilling, turning, facing, boring, chamfering, knurling, milling, laser cutting, sheet metal cutting, forming, joining, Welding, brazing, joining with adhesives, casting, forming (forging), 3D printing, painting,

Plan of product dissection (reverse engineering) (9 weeks)

Each team will use a set of hand tools to dismantle, study, document, and reassemble a product (nine different products from week to week).

Duration 2 hours per session

Plan of learning manufacturing processes (9 weeks)

The teams will see demonstrations of processes and each student will execute the process with their own hands.

Duration 2 hours per session

Plan of project (4 weeks)

Each team will make a product that has several components; each student will make a few components. After complete manufacturing, the team will assemble the products to realize the product.

Each team will make a different product and show case it at an expo at the end of the semester.

Duration 4 hours per session, additionally more time as per students' convenience.

Session Plan

NO.	TOPIC TITLE	TOPIC & SUBTOPIC DETAILS	READINGS,CASES,ETC.	ACTIVITIES	IMPORTANT DATES
1	Reverse Engineering (RE) and Manufacturing processes (MP)	RE 1 (e.g. Hand pump) and MP 1 (e.g. Turning, and milling)	Safety instruction videos, Document for reverse engineering, and read about the manufacturing process to be performed, See the activity sheet	Submit report in groups for both activities	
2	Reverse Engineering (RE) and Manufacturing processes (MP)	RE 2 (e.g. Toaster) and MP 2 (e.g. Wood working)	Read about manufacturing process to be performed, watch instructional videos posted on LMS	Submit report in groups for both activities	
3	Reverse Engineering (RE) and Manufacturing processes (MP)	RE 3 (e.g. Hair dryer) and MP 3 (e.g. Sheet metal working)	Read about manufacturing process to be performed, watch instructional videos posted on LMS	Submit report in groups for both activities	
4	Reverse Engineering (RE) and Manufacturing processes (MP)	RE 4 (e.g. Ceiling fan) and MP 4 (e.g. Welding)	Read about manufacturing process to be performed, watch instructional videos posted on LMS	Submit report in groups for both activities	
5	Reverse Engineering (RE) and Manufacturing processes (MP)	RE 5 (e.g. Toilet flush) and MP 5 (e.g. LASER/3-D printing)	Read about manufacturing process to be performed, watch instructional videos posted on LMS	Submit report in groups for both activities	
6	Reverse Engineering (RE) and Manufacturing processes (MP)	RE 6 (e.g. Umbrella) and MP 6 (e.g. Molding)	Read about manufacturing process to be performed, watch instructional videos posted on LMS	Submit report in groups for both activities	

7	Reverse Engineering (RE) and Manufacturing processes (MP)	RE 7 (e.g. LPG stove) and MP 7 (e.g. Weaving)	Read about manufacturing process to be performed, watch instructional videos posted on LMS	Submit report in groups for both activities	
8	Reverse Engineering (RE) and Manufacturing processes (MP)	RE 8 (e.g. Mixer/Grinder) and MP 8 (e.g. Origami)	Read about manufacturing process to be performed, watch instructional videos posted on LMS	Submit report in groups for both activities	
9	Reverse Engineering (RE) and Manufacturing processes (MP)	RE 9 (e.g. Pipe Valve) and MP 9 (e.g. Finishing)	Read about manufacturing process to be performed, watch instructional videos posted on LMS	Submit report in groups for both activities	
10	Project Execution	Project Exploration and definition	Videos of previously made projects	Sample projects: Toy crane, table lamp, soda machine, Origami door, Meccano toys, Small swing, Fruit stand, Fingerprint locker, Dog house, Brick house, Corner table, Bird house, and Suspension bridge	
11	Project Execution	Project Proposal (including bill of materials)	Proposal format	Submit the project proposal	
12	Project Execution	Project Manufacturing	Project progress report	Submit the project progress report	
13	Project Execution	Project assembly and finishing	Project final report	Submit project final report	
14	Review and Revision-1	Review	Earlier documents	Review the work done	
15	Review and Revision-2	Make-up session			
16	End sem quiz	Evaluation			

17	Project evaluation-1	Viva, and product demonstration			
18	Project evaluation-2	Viva, and product demonstration			

