zyBooks
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Manufacturing Processes: Course Resources

Video Playlists

ToolingU-SME
https://www.youtube.com/@ToolingUSME

Steel fabrication processes, primarily construction steel, CorusBCSATraining (playlist)
https://www.youtube.com/playlist?list=PL450103743D05E756

Forging, Anyang Forging Press (multiple playlists)
https://www.youtube.com/@anyangforgingpresscompany/playlists

Casting
https://www.youtube.com/@supervacfoundryyt5152

Curated videos for Groover's Fundamentals of Modern Manufacturing zyBook chapters

5. Dimensions, Surfaces, and Their Measurement
Measurements and gaging https://www.youtube.com/watch?v=kTuxdk6ar9Y
Hardness testing https://www.youtube.com/watch?v=ku0S2fkMgG4

9. Composite Materials
Composite materials and manufacturing https://www.youtube.com/watch?v=slgtMk8k4Ik
Composite materials https://www.youtube.com/watch?v=haYuTANzzS8

10. Fundamentals of Metal Casting
Casting https://www.youtube.com/watch?v=28_I7Bdz4yY

11. Metal Casting Processes
Sand casting, manual https://youtu.be/szOwGvYO_Tc
Shell molding https://www.youtube.com/watch?v=UPgVhCLUpRQ,
https://www.youtube.com/watch?v=i59e8_6s_3s
Investment casting hollow core (animation) https://www.youtube.com/watch?v=HtidZOsmFXg
Investment casting (animation) https://www.youtube.com/watch?v=y3vEhF6f-Z4 Permanent

gravity mold (animation) https://www.youtube.com/watch?v=b7_LEp5aNXA Split mold casting (animation) https://www.youtube.com/watch?v=FaBg-hMjdLg Sand casting (animation) https://www.youtube.com/watch?v=oHPFKbRSWLw Die casting (animation) https://www.youtube.com/watch?v=_V9oyvWovHQ Lost foam casting (animation) https://www.youtube.com/watch?v=GYht8qVcbUs Investment casting https://www.youtube.com/watch?v=dwhGumjuYB4
Die casting https://www.youtube.com/watch?v=H5V9yw9oyDI
Die casting https://www.youtube.com/watch?v=0XkDK46rwvQ
Permanent mold casting https://www.youtube.com/watch?v=cwT4U-qvJ-s
Sand casting https://www.youtube.com/watch?v=UBeUp-oP7Lk
Investment casting: https://youtu.be/2bUF_BvZcAQ
Rotational casting of a pipe: https://youtu.be/3G2sBqXkRT8
Green sand casting https://www.youtube.com/watch?v=NMBtpbhaQI0

12. Glassworking
Fusion draw https://youtu.be/Zig7vHjyVk8
Press and blow https://youtu.be/l7cdYtR_Lq0

13. Shaping Processes for Plastics
Plastic injection molding explanation https://youtu.be/RMjtmsr3CqA Plastic injection molds https://www.youtube.com/watch?v=vDGgjZrmbUo Plastic blow molding https://www.youtube.com/watch?v=WLyaZbT97EI Plastic injection molding https://www.youtube.com/watch?v=d4F9jvMBk0Y Plastics finishing https://www.youtube.com/watch?v=8e-aVAmugEw Plastics machining and assembly https://www.youtube.com/watch?v=1d3Gp8BdO9M Plastic thermoforming https://www.youtube.com/watch?v=p5M0YI2BUjE

14. Processing of Polymer Matrix Composites and Rubber
Composite layups (manual) https://www.youtube.com/watch?v=ZotUR_GiVK8
Composite layups (automated) https://www.youtube.com/watch?v=DI2xVPVif0w
Filament winding https://www.youtube.com/watch?v=4ihtyjydzqA Pultrusion https://www.youtube.com/watch?v=aXq1hrzne2k
Liquid molding https://www.youtube.com/watch?v=jfO56D9yevg
Compression molding https://www.youtube.com/watch?v=Gd1dkrX8JFU
Composites joining https://www.youtube.com/watch?v=y3WTnCsMLxM

15. Powder Metallurgy
Powder metallurgy https://www.youtube.com/watch?v=N4-kfSD6XJI Powder metallurgy (animation) https://www.youtube.com/watch?v=z5327SSM6G0 Powder metallurgy https://youtu.be/MgukjCT9o80

18. Bulk Deformation Processes in Metal Working
Forging https://www.youtube.com/watch?v=wSbywBfXlHg

Open and closed die forging https://youtu.be/x10pOu05Wtw
Open die forging https://youtu.be/7xxPW12S0KI
Roll forming sheet metal https://youtu.be/k6iODHla6qY
Roll forming (animation) https://www.youtube.com/watch?v=hejopAGM1MY
Open die forging https://youtu.be/_9HYhS3K3HA
Closed die forging https://youtu.be/mvV6tnbttKQ

19. Sheet Metalworking
Sheet metal Hydroforming https://www.youtube.com/watch?v=vsno1buTLBk Sheet metal coil processing https://www.youtube.com/watch?v=7tmHDNC8qos
Sheetmetal shearing and bending https://www.youtube.com/watch?v=o5zTUo2t7_w
Punch presses https://www.youtube.com/watch?v=Bx5fBZlvzAU
Sheetmetal press brake https://www.youtube.com/watch?v=fahk_tytyLY
Tube bending https://www.youtube.com/watch?v=UPY6FW1uQ_k
Sheet metal bending showing spring back
https://youtu.be/8Kfyf4oMVdI A progressive die
https://www.youtube.com/watch?v=hxv8fB4IXwk Progressive die in action https://youtu.be/rtuHFcUFtWs
Sheet metal stamping https://www.youtube.com/watch?v=Fy_czoSfbRE
Progressive dies https://www.youtube.com/watch?v=5CuJjSk4U38
Sheet metal progressive die https://youtu.be/_U7uwcWna0g

21. Machining Operations and Machine Tools
Gears https://www.youtube.com/watch?v=8s4zm_ajxAA
CNC https://www.youtube.com/watch?v=VKvISyYRjIY
Turning and lathes https://www.youtube.com/watch?v=8EsAxOnzEms Milling and machining centers https://www.youtube.com/watch?v=Ef59DogwLrI
Drilling https://www.youtube.com/watch?v=_VFyL9dxgrY
Threading https://www.youtube.com/watch?v=uI6HvDV7BLU
Working holding https://www.youtube.com/watch?v=Cs0vy42gUkQ Six spindle lathe (example starts at 2:30) https://www.youtube.com/F4JoQ3C9ZzM

22. Cutting-Tool Technology
Cutting tool material https://www.youtube.com/watch?v=VFBMJHdqjcs
Cutting tool geometry https://www.youtube.com/watch?v=KSl3dLeeJ5g
Metal cutting fluids https://www.youtube.com/watch?v=-o5luQ5Tw80

24. Grinding and Other Abrasive Processes
Grinding https://www.youtube.com/watch?v=uqBTmj5vupI

25. Nontraditional Machining and Thermal Cutting Processes
Thermal and abrasive water jet cutting https://www.youtube.com/watch?v=NOiXh80_jXU
EDM https://www.youtube.com/watch?v=L1D5DLWWMp8

26. Heat Treatment of Metals
Heat treating https://www.youtube.com/watch?v=XcMX5o-kjIY

27. Surface Processing Operations
Deburring https://www.youtube.com/watch?v=UdhjZSx-JGY
Painting and powder coating https://www.youtube.com/watch?v=RpXH7AqnVK8
Plating and coating https://www.youtube.com/watch?v=aDkpbB31Iek

29. Welding Processes
Welding https://www.youtube.com/watch?v=DcIM73AXLsg Manual welding https://www.youtube.com/watch?v=CXfFlUJxlE4 Welding robot https://www.youtube.com/watch?v=zU_GDM02E-A Friction stir welding explanation https://youtu.be/4w1RFnLnexg Submerged arc welding https://www.youtube.com/watch?v=wR3IwpWLijg MIG welding https://www.youtube.com/watch?v=xwqqW5CbIMI SMAW https://youtu.be/mT38K_YsHM4

30. Brazing, Soldering, and Adhesive Bonding
Soldering and brazing https://www.youtube.com/watch?v=HJBrsSvwUII

31. Mechanical Assembly
Fastening and assembly https://www.youtube.com/watch?v=4GXt02w66Tg

32. Additive Manufacturing
Rapid prototyping https://www.youtube.com/watch?v=3Oa6RxjU4gI

34. Electronics Assembly and Packaging
Reflow and wave soldering https://youtu.be/saOHrw4ezGw

Economics-related challenge activities

(auto-graded homework in the Groover Fundamentals of Modern Manufacturing Processes zyBook)

Introduction and Overview of Manufacturing
1.5.1 Calculating production times in a manufacturing process.
1.5.2 Determining piece costs in a simple manufacturing process.
1.5.3 Including overhead costs in a manufacturing process.
1.5.4 Calculating piece costs in a complex manufacturing process.

Fundamentals of Metal Casting
10.2.3 Calculating the time to fill a casting mold.

Metal Casting Processes
11.6.1 Calculating the time required and unit heat and pouring energy of casting parts. 11.6.2 Determining the power and electricity cost in a casting operation. 11.6.3 Evaluating the economics of casting parts in a sand-casting production line.

Shaping Processes for Plastics
13.2.4 Calculating material cost in extrusion.
13.2.5 Determining production costs in extrusion.
13.6.2 Determining production time and costs for an injection molding process.

Powder Metallurgy
15.5.1 Calculating the cost per part of a blending and mixing operation. 15.5.2 Computing the part cost of a pressing cycle.
15.5.3 Evaluating the cost per part of a sintering process.
15.5.4 Analyzing the economics of a conventional press-and-sinter operation.

Sheet Metalworking
19.4.1 Calculating production time and rate in a sheet metal bending operation. 19.4.2 Evaluating production times for an automated turret press.
19.4.3 Determining piece cost for a progressive die.

Machining Operations and Machine Tools
21.2.1 Calculating machining time in a facing operation.
21.2.2 Determining metal removal rates in turning.
21.2.3 Calculating machining time in a boring operation.
21.2.4 Determining machining time for a two step turning operation.
21.3.1 Calculating cutting time and metal removal rate when drilling a blind hole.
21.3.2 Calculating cutting time and metal removal rate when drilling a through hole.
21.3.3 Determining cutting time and feed rate for a two spindle drilling operation.
21.4.4 Determining machining time in milling.

Economic and Product Design Considerations in Machining
23.3.3 Maximizing the production rate for high-speed steel and cemented carbide turning operations.
23.3.4 Calculating the cutting speed and machining time when minimizing the cost in a turning operation.
23.3.5 Computing the tool life and cycle time in a turning operation for minimal cost per unit.
23.3.6 Minimizing the cost per unit for high-speed steel and cemented carbide turning operations.

Welding Processes
29.7.1 Evaluating the performance of a shielded metal arc-welding operation.

29.7.2 Evaluating the performance of a flux-cored arc-welding operation.
29.7.3 Evaluating the performance of a gas metal arc-welding operation.

Additive Manufacturing
32.3.1 Calculating cycle time for a FDM process.
32.3.2 Calculating cycle time for a binder jetting process.
32.3.3 Determining cycle time for an irregular shaped piece fabricated with FDM.
32.3.4 Calculating piece cost in additive manufacturing.

Automation Technologies for Manufacturing Systems
38.3.1 Determining the number of shifts for a manual assembly line.
38.3.2 Determining the minimum number of workers for a manual assembly line.
38.4.1 Calculating production rates for an automated dial indexing table. 38.4.3 Evaluating costs and failure rates for an automated synchronous transfer line.

Design Resources

Coverage in Groover's Fundamentals of Modern Manufacturing zyBook:

Metal Casting Processes
11.7 Product design considerations

Glassworking
12.4 Product design considerations

Plastics
13.12 Product design considerations

Powder Metallurgy
15.6 Product design considerations in powder metallurgy

Ceramics and Cermets
16.4 Product design considerations

Machining
23.4 Product design considerations in machining

Welding
29.8 Design considerations in welding

Mechanical Assembly
31.6 Design for assembly

Online resources

https://www.teachengineering.org/populartopics/designprocess Intended for K-12 use, but can be used in higher education settings

https://toolpath.com/
Tool path generator and cost estimator recommended by webinar participant

Other potential projects / assignments:

- Select a process that can achieve the desired design.
    - Optimal design with expensive process vs suboptimal design with inexpensive process
- Select a material to meet a design spec.
    - Which materials are optimal for each fabrication method
- Making changes to a specific part to make it possible to fabricate ● Short term or semester-long design project: hypothetical or including fabrication if there is access