ART 183-01, Sum. I, 2024 **METAL FABRICATION, Syllabus Name_____**

Code #70003. **Sean M. Monaghan, M.F.A. Tel: 831-331-3536; Email: smonaghan@ucsc.edu**
Tues & Thur, 9:30am-3:00pm, June 25- July 25, Summer Session I, 2024. Classroom is Baskin P101.
SRA: Raissa Boysen, rmboysen@ucsc.edu. Monitors' contact information will be posted in classroom.
Head of Studio Operations: J Gaston, jmgaston@ucsc.edu and Courtney Scruggs: cscruggs@ucsc.edu.
Prerequisites are waived for this summer course. May be repeated for credit. Material fee approx. $95.

COURSE DESCRIPTION: Intermediate and advanced students will explore the expression of ideas in three dimensions by learning welding, cutting, forming techniques and other processes of metal work by way of demonstrations, lectures, studio work and field trips where feasible. You may wish to find some materials outside of class. Critical thinking, discussion and creative communication of ideas will be stressed as students integrate their sculptural idiom with the skills needed to realize a complete artwork.

PROGRAM LEARNING OUTCOMES:
1. Proficiency in a range of techniques and media. 2. Ability to imagine, create and resolve a work of art. 3. Familiarity with--and ability to--analyze verbally and in writing, issues and forms of contemporary art with a clear understanding of historical precedents. 4. The ability to articulate an insightful response and analysis of a work of art in order to participate in discussions and studio critiques.

EVALUATION/GRADING: Students will be evaluated in five areas, with a maximum of **100 pts**:
A (90+ pts.) Excellent; **B** (80+ pts.) Very good; **C** (70+ pts.) Satisfactory; **D** (60+pts.); **F** (59 or fewer).
Points determined by combining strength of ideas and concepts with presentation of the finished project.

1) **25 pts:** **Attendance required at every class.** **-5 pts.** for missing a class w/o notice, 2 misses = drop.
2) **10 pts:** **Five Basic Exercises:** (2 pts ea.) **Plan, Prep, Layout** (draw, measure, patterns, templates, remove rust, oil, slag); **Cut** (Plasma, Oxy/Acet, grinder w/cutting wheel, chop saw, shears); **Bend** (Hot: gas heat, hammer, anvil, Cold: slip roller, break, vice or stakes); **Join** (Hot: Gas, MIG, TIG, braze, solder; Cold: bolt, tap, rivet); **Finish**: (file, sand, burnish, seal, display, etc.)
3) **20 pts:** **Lantern Project:** Design, cut and weld the provided steel material into a 'Lantern' form.
4) **30 pts:** **Kinetic Sculpture, Wearable Art or other Approved Final Project:** Design and make a simple 'machine' or sculpture that moves, or a piece that can be worn or will enhance a bodily function, or propose a unique project.
5) **10 pts:** **Clean Ups:** Full participation required: One on first day, one after each project (2.5 pt. ea.).
6) **5 pts:** **Notebook Review**: One final notebook check: sketches, all handouts, quizzes, etc., w/name.

TEXTS: Required Handouts and instructional materials will be provided.

MATERIALS: Required materials will be provided. Students may bring in approved outside materials.

SAFETY: Safety procedures must be followed as demonstrated. Students must wear cotton or leather long pants and close-toed shoes to class. Other safety gear provided. **Cowell Health Center: 459-2211**

EQUAL ACCESS: UC Santa Cruz is committed to creating an academic environment that supports its diverse student body. If you are a student with a disability who requires accommodations to achieve equal and full access in this course, please submit your Accommodation Authorization Letter from the Disability Resource Center (DRC) to me privately during my office hours or by appointment, preferably within the first two weeks of the quarter. Learn more about DRC services by contacting DRC by phone at 831-459-2089 or by email at drc@ucsc.edu. Find many more campus resources for students at https://art.ucsc.edu/links-to-student-resources.

Notify instructor of any injuries or damaged equipment. Be aware of your surroundings.
Keep tables and floors CLEAN. Clean up your stations as you work and at the end of every class!

ART 183, Sum. I, 2024 **METAL FABRICATION, Schedule Name_____**

6/25 (tue) 9:30-12: Course Overview, slides, Safety Demo. Grind tables smooth. *12-1 Lunch Break.*
1-3: Demonstrate processes and begin Five Basic Exercises:
Planning and prep (Gather, layout, draw, measure, squares, patterns, templates);
Cut (Hot: Plasma, oxy/acet; Cold: angle grinder, chop saw, foot and Beverly shears);
Bend (Hot: gas heat, hammer, anvil; Cold: slip roller, vice or stakes);
Join (Hot: MIG {*TIG; Oxy/Acet, braze, solder*}; Cold: drill, bolt, screw, rivet {*tap*});
Finish (Sanding, file, burnish, sandblast, color, seal, presentation, etc.).

6/27 (thu) 9:30-12: Finish 5 Basic Exercises. *12-1 Lunch break*

1-3: Continue working on 5 Basic Exercises and begin Sketches for Lantern Project.

7/2 (tue) 9:30-12: Continue working on 5 Basic Exercises. *12-1 Lunch Break.*

1-2: Critique 5 Exercises and look at Sketches for Lanterns. 2-3: Begin Working.

7/4 (thu) **<<** *No Class* >>
<< Independence Day Holiday >>

7/9 *(***tue***)* **9:30-12: Continue working on Lantern Project.** *12-1 Lunch Break.*

1-3: Continue working on Lantern Project.

7/11 (thu) 9:30-12: Continue working on Lantern Project. *12-1 Lunch Break.*

1-2: Slides: Kinetic, Wearable or other Approved Final Project. 2-3: Begin Sketches.

7/16 (tue) 9:30-12: Finish Lantern Project. *12-1 Lunch Break.*

1-2: Critique Lantern & look at Final Project sketches. 2-3: CLEAN and begin working.

7/18 (thu) 9:30-12: Work on Kinetic, Wearable or other Approved Final Project. *12-1 Lunch Break.*

1-3: Continue working on Final Project.

7/23 (tue) 9:30-12: Continue working on Final Project. *12-1 Lunch Break.*

1-3: Continue working on Final Project.

7/25 (thu) 9:30-12: Finish Final Project. *12-1 Lunch Break.*

1-2: CLEAN; 2-3: Final Project Critique.

Welding supplies: County Specialty Gasses (River St.), **Gen. supplies**: San Lorenzo Lumber (River St.)
Steel: Central Coast Welding (Ingalls St.), Geo Wilson (Harvey West); **Copper**: Bruce Mech. (Coral St.)
Misc. found objects and scrap: City Dump (Dimeo Lane), Bike Church (Pacific St.), Thrift stores, etc.

ART 183, Sum I, ’24 **METAL SHOP EQUIPMENT** **Name**_____

Right-angle Grinders: ***SAFETY:*** **Clear face shield or goggles. Protect eyes, ears, lungs, hands. No loose hair or clothes.** Use an electric right-angle grinder to cut, grind or sand metal. Use dust mask. Make sure that no one is in the ‘plane’ of material being removed and thrown by the grinder. Cutting discs are thin and can break easily, causing flying shards. No loose clothes or hair! **SWEEP UP!!!**

Foot Shear: ***SAFETY:*** **Make sure that no one else is located within the yellow paint marks!** Mark material (16 gauge max.) and place mark at the front edge of the blade, squarely against fence on side. Maintain balance while using both feet to press down on foot pedal with several controlled ‘push’ motions.

Beverly Shear: ***SAFETY:*** **Protect eyes & hands**. Throatless shears used to make curved cuts (in one direction) in up to 16 ga. mild sheet steel. Keep lever handle on tripod stand. Do not cut round rod!

Bolt cutters: ***SAFETY:*** **Protect eyes & hands**. Place rod in jaws. Always secure loose end with clamp!

48” Slip Roller: ***SAFETY:*** **Keep fingers away from rollers**. Up to 16 gauge steel. Hold roller open w/bar to remove a cylinder. Remove slag and place clean material at 90° to the rollers, or a ‘spiral’ will result. Gradually adjust bottom screws to tighten the radius as you go. Up to ½” rod may also be rolled.

48” Sheet Metal Box & Pan ‘Finger’ Brake: The adjustable ‘fingers’ accommodate full-length or partial bends, for boxes and pans. Up to 16 gauge mild steel sheet: Do Not use for rod or bar stock!

12” Grizzly Box &jhlh Pan Brake: 90°bends up to 18 ga. at 6” wide, up to 22 ga. at full 12” width.

Pedestal Grinder: ***SAFETY:*** **Clear face shield or goggles. Protect eyes, ears, lungs, hands. No loose hair or clothes.** Hold work at front of wheel. **Wire Wheel can grab your piece or shed dangerous wires.**

Floor Drill Press: ***SAFETY:*** **Clear face shield or goggles. Protect eyes, ears, lungs, hands. No loose hair or clothes.** Table can be adjusted up, down, left, right. Secure work with clamp or vice. Secure drill bit chuck with key. Always remove chuck key before turning on! Adjust speed with black dial: use slower speeds to drill metal. **Push Red Button** to stop. Use feed lever to slowly lower bit.

Metal Chop Saw: ***SAFETY:*** **Clear face shield or goggles. Protect eyes, ears, lungs, hands. No loose hair or clothes.** Secure work against fence with vice. Leave guard in place. Press switch and cut **slowly.**

12” Disc Sander: ***SAFETY:*** **Clear face shield or goggles. Protect eyes, ears, lungs, hands. No loose hair or clothes.** Place material on left side of table. Final finishing of flat pieces only! (Disc dulls quickly).

Small Ring Roller: ***SAFETY:*** **Protect eyes and hands.** Turn handle to feed ¼” max. rod or 1/8” max. flat bar into rollers, turning knob until material grabs. Adjust to desired size, 3” min. dia. Loosen to release.

Tubing/Bar Bender: ***SAFETY:*** **Protect eyes and hands.** Round or square dies (3/8”-3/4”) for curves up to 150°. Set die against stop, place tubing through hole, adjust roller in handle to correct distance.

Homemade Bender: Place rod or tube against vertical pin. Use arm to bend material to desired radius.

English Wheel: **Safety: Protect eyes and hands.** Create smooth compound curves in up to 18 ga. mild sheet steel. Fixed upper roll with various lower anvil rolls that may be exchanged to make various curves.

Sandbag: ***SAFETY:*** **Protect eyes, ears & hands.** Place material (not hot!) on leather bag and shape it by striking it with provided ball pein hammer, heavy slapping spoon, etc. Do not puncture sandbag!

ART 183, Sum I, '24 **WELDING and HOT CUTTING, Pt. I Name_____**

Welding Terminology:

Welding: Any method—usually 'hot'—for fusing pieces of similar metal: Arc (1802) or Gas (1903).
Arc Welding: Uses an electrical arc to weld: Stick, MIG or TIG (or **GMAW:** Gas Metal Arc Welding)
Braze: Joining base metal (usually steel) with different filler metal (usually brass or bronze) at high temperatures (~2,000°F). **Solder:** Like brazing, but at lower temp's (500°F ~1,500°F), often w/silver.
Flux: Use when brazing or soldering; keeps brazing area clean of oxides, allows filler to flow better.

MIG* Welding *(Millermatic 251 and 252)* **Metal Inert Gas, since 1948*

SAFETY: **Use #10 helmet. Provide adequate ventilation. Wear leather jacket, gloves, long cotton pants and close-toed shoes to protect eyes and skin from UV and IR rays.**

1. Clean and prep metal pieces, then secure with bricks or clamps into proper position for welding.
2. Turn ON Ventilation switch at wall and work near vent in order to pull harmful fumes away.
3. Ground work by attaching ground clamp, either to metal table or directly to work.
4. Check that the torch nozzle and cover are clean and in good order. Dip nozzle in Gel to keep clean.
5. Turn on Argon tank (pre-set at 20 psi). Snip off wire about 1/4" from nozzle. Turn on the MIG. **Refer to chart** to set Voltage and Wire Speed. Ex: 18 gauge = 14-15Volts, 120-130 Wire Speed.
6. Hold the torch so that the wire is about 1/8" from work. Pull the trigger to produce a weld.
7. 'Tack' the pieces to be welded. Complete the weld by moving the torch evenly along weld path.
8. When done: turn OFF power & Argon, remove ground, hang up torch. Work is hot! **Clean up!!!**

Plasma Torch Cutting *(Miller Spectrum 875)* *Since 1955*

SAFETY: **Use #5 face shield. Provide adequate ventilation. Wear hearing protection, gloves, leather jacket, long pants and close-toed shoes. Protect eyes and skin from UV and IR rays.**

1. Clean the metal of oil, etc. Mark cuts with slate or make a template (wood or metal) if necessary.
2. Turn ON ventilation switch at wall and work near vent to pull fumes away.
3. Ground work by attaching ground clamp to either the metal table or directly to piece being welded.
4. Check the torch and insure that electrode, nozzle and cover are clean and in good working order.
5. Turn on compressed air valve. Turn on the Plasma Cutter (~25 Amps for 18 gauge steel.)
6. Set to 'Cut'. Keep fingers away from cutter, and do not point at anyone. Work over a cutting table.
7. Place nozzle lightly on the piece, at 90°, on the cut line. Pull the trigger to produce a cutting arc.
8. Once metal is pierced, steadily move the nozzle along line. (A stencil may be used w/~1/8" gap.)
9. When done, turn OFF power, air, remove ground, hang up torch. Work is hot, sharp. **CLEAN UP!!**

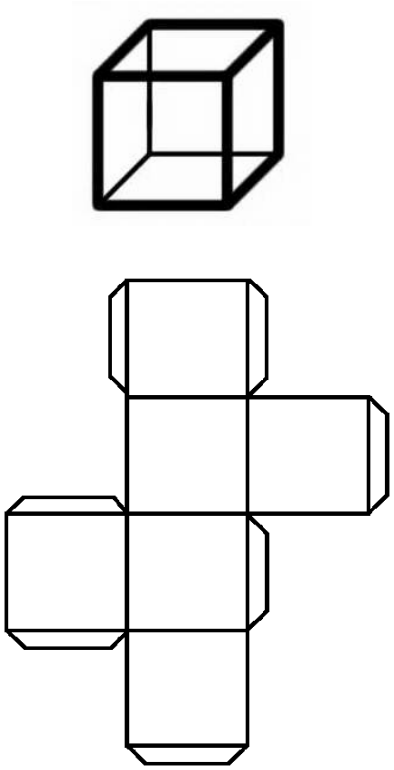
Notes:

Steel rod appears reddish, because it is copper-plated. It is magnetic and it will spark.
Brass rod appears 'yellow,' **Bronze rod** looks 'pink-orange.' These are not magnetic and won't spark.
Stainless steel rod is not coated, therefore it appears 'silvery'. It is not magnetic but it will spark.
Most Valves are 'righty-tighty' (clockwise) to close, 'lefty-loosey' to open**.**
'Disc' and 'Ball' valves only turn 90°: handle is in line w/pipe if 'Open,' crosses pipe if 'Closed.'
Fuel line threads for Acetylene and Propane are reversed for safety, to avoid misconnection.
Pressure Regulators (Oxygen, Acetylene and Compressed air) work in reverse: 'Open' by turning clockwise, 'Close' by turning counter-clockwise. (Only unscrew until loose. Do not allow to fall out.)
1.

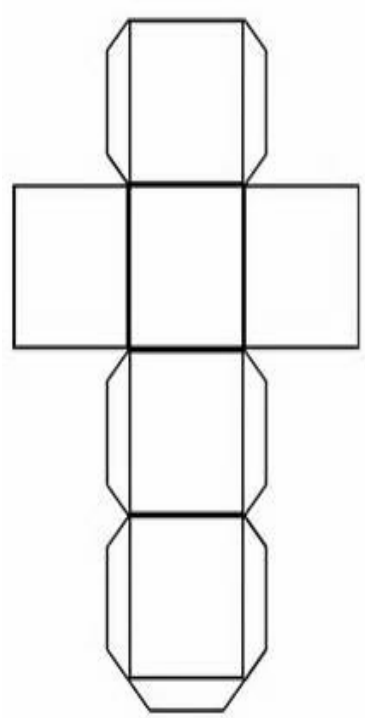
ART 183-01, Sum. I, 2024 **LANTERN PROJECT** **Name**_____

Pick one of your Lantern sketches and use paper and scissors with tape to make a 3-D pattern, or 'maquette' of the sketch. Paper may be folded, bent, layered, faceted, etc., and held in place with tape or tabs, etc.

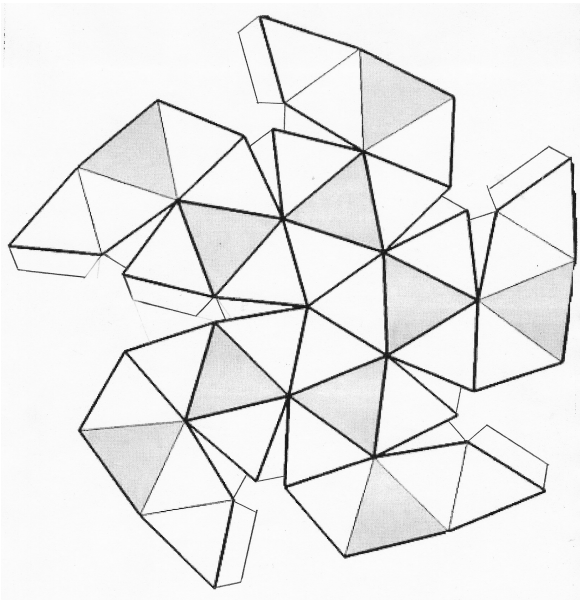
To make a Cube:



Rectangular Box:



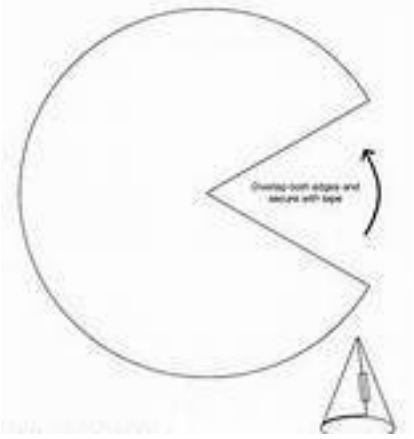
To make a Dome
(or half of a Sphere):



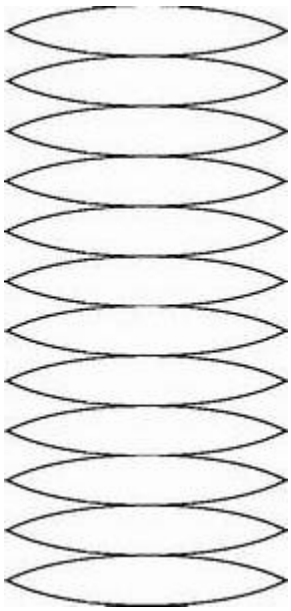
To make a Cone:

1) Pick height (h) & radius (r)
2) Calculate slope = $\sqrt{(h^2 + r^2)}$
3) Cut circle where r = slope
4) Remove sector angle: **θ**

θ = 360°−{(360° x r) ÷ slope}



To make a Sphere:



To make a Human Head: