

Las Positas College  
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## Course Outline for WLDT 72A

### BEGINNING LASER WELDING

Effective: Spring 2018

#### I. CATALOG DESCRIPTION:

WLDT 72A — BEGINNING LASER WELDING — 2.00 units

This course will cover the theory and concepts associated with modern laser welding of metals and materials. The use of the laser in the manufacturing environment will be shown along with typical applications. The different types of lasers available for welding. The advantages and disadvantages of continuous power laser welding and pulsed laser welding.

2.00 Units Lecture

#### **Strongly Recommended**

MATH 71 - Applied Math for Technicians  
with a minimum grade of C  
or

MATH 71A - Applied Mathematics for Technicians A  
with a minimum grade of C  
and/or

MATH 71B - Applied Mathematics for Technicians B  
with a minimum grade of C

#### **Grading Methods:**

Letter or P/NP

#### **Discipline:**

- Welding

	<b>MIN</b>
<b>Lecture Hours:</b>	36.00
<b>Total Hours:</b>	36.00

#### II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

#### III. PREREQUISITE AND/OR ADVISORY SKILLS:

**Before entering this course, it is strongly recommended that the student should be able to:**

##### A. MATH71

1. Accurately perform arithmetic calculations with whole numbers and fractions by hand;
2. Demonstrate competence using a calculator to perform arithmetic calculations with integers, fractions and decimal numbers;
3. Demonstrate a knowledge of the English and metric units of length, area, volume, mass, temperature and time;
4. Solve applied problems involving arithmetic operations and measurement;
5. Perform length, weight and capacity reductions and conversions between the English and metric systems;
6. Evaluate and simplify formulas and expressions;
7. Solve linear equations and formulas using the addition and multiplication principles of equality;
8. Demonstrate a knowledge of ratios, proportions and percentages;
9. Solve applied problems involving ratios, proportions and percentages;
10. Apply principles of plane geometry to solve problems involving angles, areas and perimeter;
11. Apply principles of solid geometry to solve problems involving surface area, lateral surface area and volume;
12. Perform elementary calculations involving trigonometric ratios and radian/degree conversions;
13. Solve triangle problems using right-triangle trigonometry, the Law of Sines or the Law of Cosines;
14. Demonstrate an ability to accurately use measuring instruments.

##### B. MATH71A

1. Accurately perform arithmetic calculations with whole numbers and fractions by hand;
2. Demonstrate competence using a calculator to perform arithmetic calculations with integers, fractions and decimal numbers;
3. Demonstrate a knowledge of the English and metric units of length, area, volume, mass, temperature and time;
4. Solve applied problems involving arithmetic operations and measurement;
5. Perform length, weight and capacity reductions and conversions between the English and metric systems;
6. Demonstrate a knowledge of ratios, proportions and percentages;
7. Solve applied problems involving ratios, proportions and percentages;
8. Demonstrate an ability to accurately use measuring instruments.

#### C. MATH71B

1. Accurately perform arithmetic calculations with whole numbers and fractions by hand;
2. Demonstrate competence using a calculator to perform arithmetic calculations with integers, fractions and decimal numbers;
3. Demonstrate a knowledge of the English and metric units of length, area, volume, mass, temperature and time;
4. Solve applied problems involving arithmetic operations and measurement;
5. Perform length, weight and capacity reductions and conversions between the English and metric systems;
6. Evaluate and simplify formulas and expressions;
7. Solve linear equations and formulas using the addition and multiplication principles of equality;
8. Demonstrate a knowledge of ratios, proportions and percentages;
9. Solve applied problems involving ratios, proportions and percentages;
10. Apply principles of plane geometry to solve problems involving angles, areas and perimeter;
11. Apply principles of solid geometry to solve problems involving surface area, lateral surface area and volume;
12. Perform elementary calculations involving trigonometric ratios and radian/degree conversions;
13. Solve triangle problems using right-triangle trigonometry, the Law of Sines or the Law of Cosines;
14. Demonstrate an ability to accurately use measuring instruments.

#### IV. MEASURABLE OBJECTIVES:

**Upon completion of this course, the student should be able to:**

- A. Explain the basic types of lasers used for industrial welding and cutting;
- B. Describe the basic concepts associated with lasers and how the beam is generated;
- C. Explain the concept of power density;
- D. Describe the types of metals and materials that can be processed with lasers;
- E. List the components of the beam delivery optics;
- F. Explain the concept of pulsed laser welding and its advantages, disadvantages and applications;
- G. Explain the concept of continuous power laser welding and its advantages, disadvantages and applications;
- H. Explain the role of shielding gas and the gasses used for laser welding and cutting;
- I. Explain why metallurgy of laser welding differs from that of conventional welding techniques ;
- J. Explain the process of Laser cutting;

#### V. CONTENT:

- A. Basic concepts associated with lasers and how the beam is generated
- B. Basic types of lasers used for industrial welding and cutting
- C. Concept of power density
- D. The types of metals and materials that can be processed with lasers
- E. The components of the beam delivery optics
- F. Pulsed laser welding and its advantages, disadvantages and applications
- G. Continuous power laser welding and its advantages, disadvantages and applications
- H. Shielding gas and the gasses used for laser welding and cutting
- I. The concept of Equipment Qualification (EQ)
- J. Laser Cutting

#### VI. METHODS OF INSTRUCTION:

- A. **Lecture** -
- B. Textbook reading assignment; additional internet and/or print assignment
- C. **Field Trips** -
- D. Presentation of audio-visual materials
- E. Class and group discussions

#### VII. TYPICAL ASSIGNMENTS:

- A. Lectures
  1. The basics of a fiber laser.
  2. How to measure laser beam power.
- B. Reading assignment:
  1. Read the textbook chapter on types of materials that can be welded using lasers
  2. Locate and read an article off the internet authored in the last 90 days on the subject of laser materials processing, write a summary of what you read
- C. Homework:
  1. Read the textbook chapter on shielding gas and answer the questions at the end of the chapter:
- D. Class and group discussions:
  1. Class discussion: Why use lasers to weld a part vs. some other welding process?
  2. Group discussion: What are the effects of dirty optics in the laser welding equipment?
- E. Audio-visual materials:
  1. Video of laser welding processes
- F. Field trip:
  1. Visit a local medical device manufacturer
- G. Research project:
  1. What are the disadvantages of laser welding , and why?

#### VIII. EVALUATION:

##### A. **Methods**

1. Exams/Tests
2. Quizzes
3. Class Participation
4. Class Work
5. Home Work

##### B. **Frequency**

1. Midterm and Final Examinations middle and end of semester
2. Weekly Quizzes
3. Class participation daily
4. Class work as assigned
5. Weekly homework evaluation

#### IX. TYPICAL TEXTS:

1. Steen, W.M., & Mazumder, J. (2010). *Laser Material Processing* (4th ed.). London, England: Springer-Verlag.
2. American Welding Society (2017). *Process Specification and Operator Qualification for Laser Beam Welding* (C7.4M ed.). Miami,

- Florida: American Welding Society.
3. American Welding Society (2015). *Structural Welding Code - Steel* (2015 ed.). Miami, Florida: American Welding Society.
  4. Engel, S.L. (2017). *Laser Welding Technology Student Learning Manual* (1st ed.). Elk Grove , CA: HDE Technologies.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. Calculator