**Instructor:** Zak Milligan

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**Office Hours:** Monday through Friday / TBA and by appointment M-F

**Prerequisite**: UT Level II

**Important Dates:**

1st day of Class – October 1,2019

November 28th 2019 – Thanksgiving, No Class

**Textbooks:** Handouts, Introduction to Phased Array Ultrasonic Technology Applications (pdf) Will be provided.

**Topics:**

**Phased Array Ultrasonic Testing**

1. **Introduction**
	1. Terminology of PA
	2. History of PA – use with medical
	3. Responsibilities of levels of certification
2. **Basic Principles of PA**
	1. Review of ultrasonic wave theory: longitudinal and shear wave.
	2. Introduction to PA concepts and theory
3. **Equipment**
	1. Computer Based Systems
		1. Processors
		2. Control panel including input and output sockets
		3. Block diagram showing basic internal circuit modules
		4. Multiple element Multi channel configurations.
		5. Portable battery operated versus full computer-based systems.
	2. Focal law generation
		1. Onboard focal law generator
		2. External focal law generator
	3. Probes
		1. Composite materials
		2. Pitch, gap and size
		3. Passive planes
		4. Active planes
		5. Arrays: 1D, 2D, polar, annular, special shape, etc.
		6. Beam and wave forming
		7. Grating lobes
	4. Wedges
		1. Types of wage design
	5. Scanners
		1. Mechanized
		2. Manual
4. **Testing techniques**
	1. Linear scans
	2. sectorial scans
	3. Electronic scams
5. **Calibration**
	1. Active element and probe checks
	2. Wedge delay
	3. Velocity
	4. Exit point verifications
	5. Refraction angle verifications
	6. Sensitivity
	7. DAC, TCG, TVG, and ACG variables and parameters
	8. Effects of curvature
	9. Focusing affects
	10. Beam steering
	11. Acquisition gates
6. **Data collection**
	1. Single probes
	2. Multiple probes
	3. Multiple groups or multiplexing single/multiple probes
	4. Non-encoded scans
		1. Time based data storage
	5. Encoded scans
		1. Line scans
		2. Raster scans
	6. Zone discrimination
	7. Scan plans and exam coverages
		1. Sectorial
		2. Linear
		3. Electronic raster scans
	8. Probe offsets and indexing
7. **Procedures**
	1. Specific applications
		1. Material evaluations
			1. Composites
			2. Nonmetallic materials
			3. Metallic materials
			4. Base material scan
			5. Bar, rod and rail
			6. Forgings
			7. Castings
		2. Component evaluations
			1. Ease with complex geometries
				1. Turbines (blades, dovetails, rotors)
				2. Shafts, keyways, etc.
				3. Nozzles
				4. Flanges
			2. Geometric limitations
		3. World inspections
			1. Fabrication/in-service
			2. Differences in material: carbon steel, stainless steel, High temperature nickel chromium alloy, etc.
			3. Review of welding discontinuities
			4. Responses from various discontinuities
	2. Data presentations
		1. Standard (A-scan, B-scan, C scan)
		2. Other (D-scan, S-scan, etc.)
	3. Data evaluation
		1. Codes/standards/specifications
		2. Flaw characterization
		3. Flaw dimensioning
		4. Geometry
		5. Software tools
		6. Evaluation gates
	4. Reporting
		1. Imaging outputs
		2. Onboard reporting tools
		3. Plotting, ACAD, etc.
8. **Class Structure**: Lecture – Work together each class to review concepts and introduce new information.
	1. Labs – each concept including conventional UT concepts as applicable will be practiced and demonstrated in the lab.
	2. Home work will consist of studying for test and quizzes, take home test, and professional magazine article reviews presented to the class.
9. **Attendance:** The top reason employees are fired in the industry is attendance and tardiness, consequently our industry partners request that we hold our students accountable for attendance and punctuality. Daily points are given for attendance, tardiness and work ethic. Your maximum overall course grade may not exceed your overall attendance grade.
10. **Course Evaluation:**

Attendance approx. **25%**

Assignments, notes, quizzes, activities approx. **50%**

Tests approx. **25%**

1. Students who may need accommodations due to documented disabilities, who have medical information that the instructor should know, or who need special arrangements in an emergency should speak with their instructor during the first week of class. If you believe you may need accommodations but are not yet registered with the Center for Accessibility Resources (CFAR), please visit the [CFAR Website](http://www.linnbenton.edu/cfar) for steps on how to apply for services or call 541-917-4789.
2. LBCC Comprehensive Statement of Nondiscrimination
LBCC prohibits unlawful discrimination based on race, color, religion, ethnicity, use of native language, national origin, sex, sexual orientation, gender, gender identity, marital status, disability, veteran status, age, or any other status protected under applicable federal, state, or local laws. For further information, see Board Policy P1015 in our [Board Policies and Administrative Rules](http://www.linnbenton.edu/board-policies-and-administrative-rules). Title II, IX, & Section 504: Scott Rolen, CC-108, 541-917-4425; Lynne Cox, T-107B, 541-917-4806, LBCC, Albany, Oregon. To report: [linnbenton-advocate.symplicity.com/public\_report](http://linnbenton-advocate.symplicity.com/public_report)