
Departmental Seminar

Seminar Title	: Parametric Optimization of Nitrogen-Assisted Laser Drilling for Titanium Grade 9 Alloys
Speaker	: Barsharani Dash
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Venue	: ME Seminar Hall (ME-001)
Date and Time	: 31 Jul 2025 (03:00 PM)
Abstract	: Titanium Grade 9 (Ti-3Al-2.5V) is widely used in aerospace, biomedical, and high-performance engineering applications due to its excellent strength-to-weight ratio and corrosion resistance. However, conventional drilling techniques often face challenges in machining this alloy due to its low thermal conductivity and high reactivity. In this study, laser drilling with nitrogen assist gas is employed as a non-contact, high-precision method to produce micro-holes in Titanium Grade 9. The process parameters—laser power, pulse duration, repetition rate, and nitrogen gas pressure—are systematically varied and optimized using a design of experiments (DOE) approach to achieve minimal taper, reduced recast layer thickness, and improved hole circularity. Scanning Electron Microscopy (SEM) is used for evaluating hole quality, while Analysis of Variance (ANOVA) identifies the most influential parameters. The results indicate that moderate laser power, shorter pulse duration, and optimal nitrogen gas flow significantly enhance the hole integrity. This study provides a pathway for achieving high-quality, consistent hole geometry in Titanium Grade 9, with implications for precision components in critical applications.