



## Koneru Lakshmaiah Education Foundation

(Deemed to be University estd. u/s. 3 of the UGC Act, 1956)

❖ Recognised as Category 1 University by UGC ❖ Approved by AICTE ❖ ISO 21001:2018 Certified

**Campus:** Green Fields, Vaddeswaram - 522 302, Guntur District, Andhra Pradesh, INDIA.  
Phone No. +91 8645 - 350 200; www.kluniversity.in

**Admin Off:** 29-36-38, Museum Road, Governorpet, Vijayawada - 520 002. Ph: +91 - 866 - 3500122, 2577715, 2576129

### Department of Mechanical Engineering

A.Y 2025-2026, Even Semester

### Workshop Report on “Aerospace Structural Design: Role of Composite Materials and Finite Element Analysis”

The Department of Mechanical Engineering organized a one day online **workshop** on “Aerospace Structural Design: Role of Composite Materials and Finite Element Analysis” on **21-02-2026** for B.Tech students of KLEF. The workshop was delivered by **Dr. Naresh Kali, Engineer – FEA & Design, TISA Aerospace Pvt. Ltd., Hyderabad**. A total of 81 participants including 75 students and 6 faculty members actively participated in the session.



Department of  
**Mechanical Engineering**

45 YEARS OF  
EDUCATIONAL  
LEADERSHIP

nirf  
2025  
NATIONAL  
INSTITUTIONAL  
RANKING  
FRAMEWORK

RANKED 26  
AMONG ALL  
UNIVERSITIES

Resource Person

One Day online Workshop on  
**AEROSPACE  
STRUCTURAL  
DESIGN**  
Role of Composite Materials &  
Finite Element Analysis

**21-02-2026**  
SATURDAY

**Dr. NARESH KALI,**  
Engineer - FEA & Design, TISA Aerospace Pvt. Ltd., Hyderabad

Workshop Link: <https://meet.google.com/hnf-mpay-xrz>

Dr. Naresh Kali, representing TISA Aerospace Pvt. Ltd., brought valuable industry experience in aerospace structural analysis and design. The workshop aimed to bridge the gap between academic learning and real-time aerospace industry practices.

Link: <https://meet.google.com/hnf-mpay-xrz>



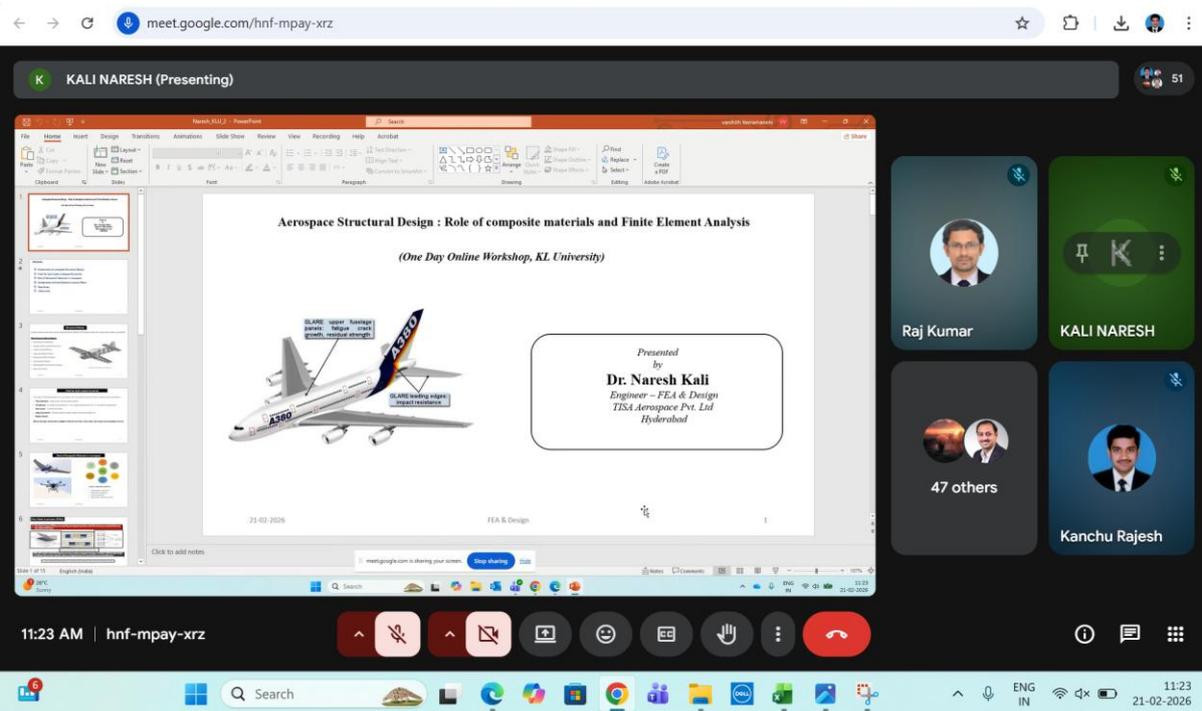
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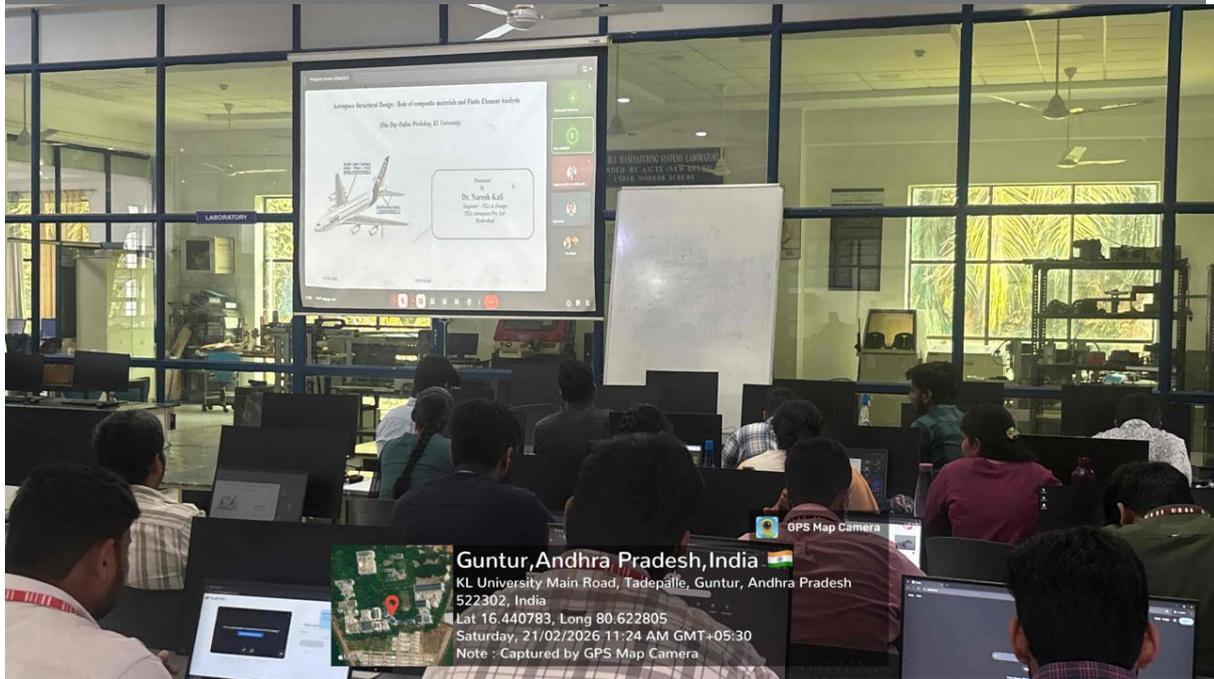
The session began with an overview of aerospace structural design principles. The resource person explained the fundamental requirements of aircraft and spacecraft structures such as strength, stiffness, fatigue resistance, fracture toughness, and safety. He emphasized that aerospace structures must withstand complex loading conditions including aerodynamic loads, thermal stresses, vibration, and impact loads while maintaining minimum weight.



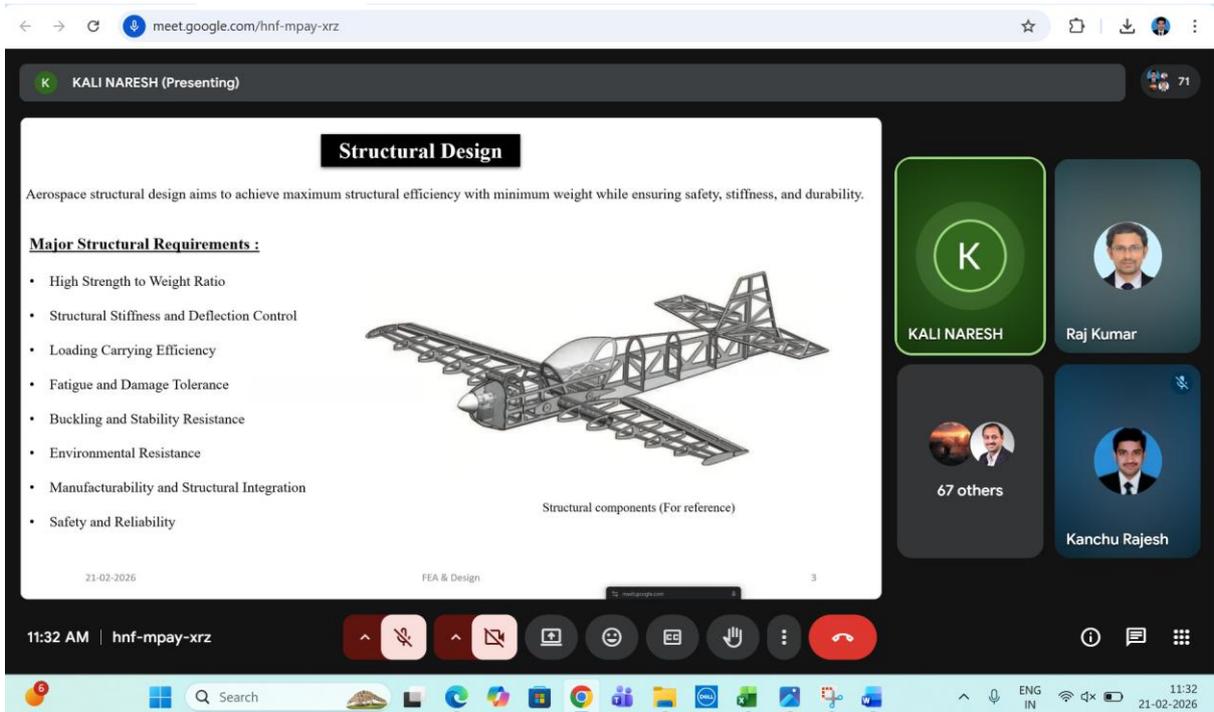
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Dr. Naresh highlighted the critical importance of lightweight structures in aerospace engineering. He explained that reducing structural weight directly improves Fuel efficiency, Payload capacity, Operational range, Overall performance. He discussed how even small weight reductions can result in significant cost savings and improved efficiency in aircraft operations.





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A major focus of the workshop was the application of composite materials in aerospace structures. The speaker explained the advantages of composites over conventional metallic materials such as High strength-to-weight ratio, High stiffness-to-weight ratio, Corrosion resistance and Tailor-made directional properties. He discussed commonly used aerospace composites such as carbon fibre reinforced polymers (CFRP) and glass fibre reinforced polymers (GFRP). The concept of anisotropy and the importance of fibre orientation in load-bearing applications were clearly explained with practical examples.



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**Role of Composite Materials in Aerospace**

Composite applications in aerospace:

- Wings (layups)
- Wing weight ribs and joints (layups)
- Engine parts (layups)
- Interior panels (layups)
- Structural parts (layups)
- Hybrid and sandwich (layups)
- Hybrid Metal (sandwich)

**Various composite materials:**

- Carbon fibre composites
- Glass fibre composites
- Kevlar composites
- Fibre Metal Laminates (FMLs)

11:36 AM | hnf-mpay-xrz



Dr. Naresh introduced Fibre Metal Laminates (FML) as hybrid materials combining metal layers and fibre-reinforced composites. He explained their improved fatigue resistance, impact tolerance, and crack arrest capability. Applications of FML in aircraft fuselage panels and structural components were discussed, highlighting their contribution to enhanced safety and performance.



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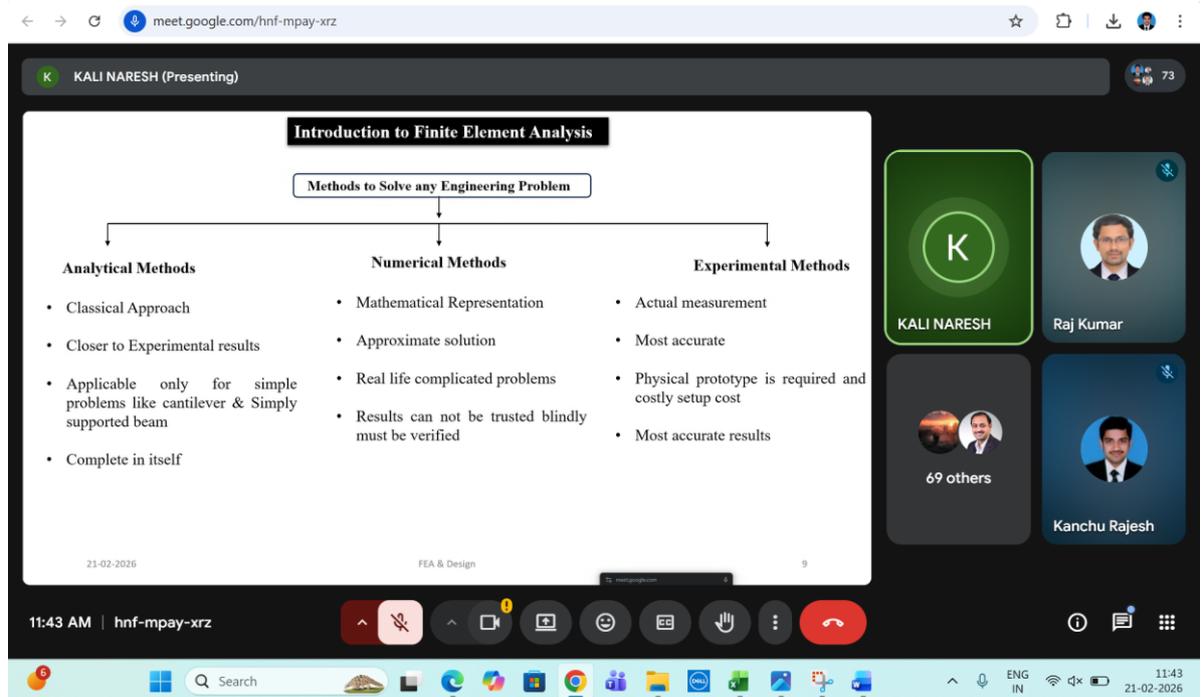
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The session then focused on the importance of Finite Element Analysis (FEA) in modern aerospace engineering. Dr. Naresh explained how FEA helps engineers Predict stress and strain distribution, analyze deformation behaviour, evaluate buckling and vibration characteristics, Optimize structural designs before physical prototyping. He described methods to solve any engineering problem using analytical, numerical and experimental methods. The importance of validation and convergence studies in achieving accurate simulation results was also emphasized.





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KALI NARESH (Presenting)

### Role of Finite Element Analysis

- Predicts stresses and deformation in aircraft structures before building prototypes
- Helps design lightweight yet strong components (wings, fuselage, spars)
- Evaluates structural safety under aerodynamic, inertial, and landing loads
- Identifies critical regions prone to failure or fatigue
- Supports composite material design and layer optimization
- Enables vibration and flutter analysis for flight stability
- Reduces physical testing cost and development time
- Improves reliability and certification readiness

Stresses and Deformations

Critical stress regions

Aerodynamic loads

FEA & Design

11:50 AM | hnf-mpay-xrz

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KALI NARESH

Raj Kumar

67 others

Kanchu Rajesh

Search

ENG IN

11:50 21-02-2026

The workshop included practical case studies from aerospace projects. These case studies demonstrated Structural optimization of aircraft components, Failure analysis using FEA, Comparison between metallic and composite structures, Weight reduction strategies through material substitution. The real-world examples provided students with a clear understanding of how theoretical knowledge is applied in industry.

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KALI NARESH (Presenting)

### Case study

Schematic view of FMLs fabrication

FML and composite samples

Materials procurement and surface treatment

Cutting of materials into required size

Calculation process to avoid agglomerates prior to mixing

Application of epoxy resin on to the metal and fibre layers and FMLs fabrication

Arrangement of metal and fibre layers into required stacking sequence

Mechanical stirring process after mixing of epoxy and hardener with nano particles

GLARE: Aluminium2024-T3, glass fibre layers, Aluminium2024-T3

Hybrid FML: Aluminium2024-T3, Glass fibre layers, Carbon fibre layers, Aluminium2024-T3

Nano particles

Hardener

Epoxy

Water

Nano particles

FEA & Design

11:51 AM | hnf-mpay-xrz

71

KALI NARESH

Raj Kumar

67 others

Kanchu Rajesh

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KALI NARESH (Presenting)

### Model verification

The present model used in this study was validated with free vibration analysis results of AI 2024-T0 ( $t=0.88$  mm) /GFRP( $t=0.56$  mm)/AI ( $t=0.88$  mm) presented by M. N. M. Merzuki [9]

Excavate boundary conditions (U1-U2-U3-UR1-UR2-UR3-0)

Fixed end

Tie constraint

AI

GFRP

AI

Free end

- Tie constraint
- linear perturbation with Lanczos Eigen solver is used in ABAQUS/CAE.
- Linear hexahedral elements of type C3D8R for both composites and metal layer
- C3D8R: An 8-node linear brick, reduced integration, hourglass control
- Total number of nodes: 5400
- Total number of elements: 2403

	Numerical [9] (Hz)	Present model (Hz)
Mode 1	30.42	29.86
Mode 2	190.28	186.5
Mode 3	532.25	522.26

Mode 1

FEA by M. N. M. Merzuki [9]

Present FEA

FEA & Design

Fig.39. Mode shapes comparison

21-02-2026

11:53 AM | hnf-mpay-xrz

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KALI NARESH

Raj Kumar

64 others

Kanchu Rajesh

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The workshop concluded with an interactive session where students raised questions regarding career opportunities in aerospace design, software tools used in FEA, and the scope of composite materials in future aerospace applications. Dr. Naresh shared insights on required technical skills, including proficiency in CAD/CAE tools and strong fundamentals in mechanics of materials.



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KALI NARESH (Presenting)

### Numerical validation of Glare FMLs under free vibration analysis

Total number of nodes: 1400  
Total number of elements: 2400  
2400 linear hexahedral elements of type C3D8R  
C3D8R: An 8-node linear brick, reduced integration, hourglass control

	Experimental values (Hz)	Numerical values (Hz)
Mode 1	28.12	33.23
Mode 2	221.27	207.75
Mode 3	681.25	631.25

U, Magnitude  
+1.000e+00  
+0.500e+00  
+0.250e+00  
+0.125e+00  
+0.062e+00  
+0.031e+00  
+0.016e+00  
+0.008e+00  
+0.004e+00  
+0.002e+00  
+0.001e+00  
-0.001e+00  
-0.002e+00  
-0.004e+00  
-0.008e+00  
-0.016e+00  
-0.031e+00  
-0.062e+00  
-0.125e+00  
-0.250e+00  
-0.500e+00  
-1.000e+00

Mode 1

Mode number	Numerical	Experimental
Mode 1		
Mode 2		
Mode 3		

Fig.41. Mode shapes for first three natural frequencies  
23-02-2026 FEA & Design

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11:55 21-02-2026

Overall, the workshop was highly informative and beneficial for students, offering exposure to advanced concepts in aerospace structural design and industrial practices. The session successfully enhanced the understanding of composite materials and the critical role of Finite Element Analysis in aerospace engineering. Faculty members appreciated the practical orientation and industry relevance of the workshop.

Prepared by

Approved by