



COURSE CONTENT

EXPERIMENTAL STRESS ANALYSIS								
I Year I Semester: M.Tech (CAD/CAM)								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2214012	Foundation	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: Mechanics of Solids, Dynamics of Machinery, Machine Design.								

Course Overview:

This course focuses on experimental stress analysis techniques for measuring strain and evaluating structural behavior. It covers strain gauges, model analysis, structural similitude, and optical methods such as photo elasticity. Advanced topics include 3D photo elasticity, stress separation, and modern optical approaches. Specialized and non-destructive testing methods provide practical tools for structural assessment in engineering applications.

Course Objectives:

1. To understand two-dimensional elasticity.
2. Expose the students with torsion of circular and non-circular sections.
3. Impart knowledge on free and forced vibrations.
4. To study transient vibrations.
5. To know classical and energy methods for free and forced vibrations of strings bars.

Course Outcomes: After Completion of the Course, Students should be able to

- CO1: Explain two-dimensional elasticity.
- CO2: Identify the difference between torsion of circular and non-circular sections.
- CO3: Understand free and forced vibrations and compute natural frequency.
- CO4: Solve problems on Transient vibrations.
- CO5: Understand classical and energy methods for free and forced vibrations of strings bars.

MODULE - I: [10]

Two-dimensional elasticity theory in Cartesian coordinates, plane stress problem in polar coordinates Thick cylinders, Rotating discs - stress concentration.

MODULE – II: [10]

Torsion of non-circular prismatic sections, rectangular and axisymmetric, Circular plates, introduction to shell theory — contact stresses.

MODULE - III: [9]

Single degree freedom, two-degree freedom system without and with damping - Free and forced vibrations, Transient vibrations.

MODULE - IV: [9]

Transient vibrations of single- and two-degree freedom systems, multi-degree of freedom systems - applications of matrix methods, continuous systems.

MODULE - V: [10]

Free and forced vibrations of strings bars and be CAD/CAM. Principle of orthogonality - classical and energy methods.

TEXT BOOKS:

1. Theory of Elasticity/Timoshenko S.P. and Goodier J. N./ Koakusha Publishers.
2. Advanced strength of materials / Den Hortog J.P./Torrent.

REFERENCE BOOKS:

1. Experimental Stress Analysis, Sadhu Singh, Dhanpat Rai Publications, Revised Edition, 2009.
2. Handbook of Experimental Stress Analysis, Max Hetenyi, John Wiley and Sons, New York, 1st Edition, 1950.
3. Photoelasticity, M.M. Frocht, Vol. I and II, John Wiley and Sons, New York, 1st Edition, 1941 (Vol. I) and 1948 (Vol. II).
4. C. Rama Rao, Experimental Stress Analysis, University Press, 1st Edition, 2013.
5. N. Ramesh Babu, Experimental Stress Analysis: Principles and Practice, Anuradha Publications, 1st Edition, 2008.
6. R.K. Rajput, Strength of Materials (For NDT and Stress Analysis Reference), S. Chand and Company, Revised Edition, 2015.

ELECTRONIC RESOURCES:

1. <https://libguides.wits.ac.za/stress-analysis>
2. <https://eng.libretexts.org>
3. <https://nptel.ac.in/courses/104112410>
4. https://ftp.idu.ac.id/wp-content/uploads/ebook/tdg/ADVANCED%20MECHANICS%20DESIGN/epdf.pub_advance-d-functional-stressanalysis.pdf
5. https://eng.libretexts.org/Bookshelves/Design_Engineering

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)