# MME40: Experimental Stress Analysis

Programme: B.Tech. (MME) Year: 2018 Semester: VIII

Course : Self study/Mooc Credits : 3 Hours : 40

**Course Context and Overview (100 words):**

The objective of this course is to enable the student to determine the stress in any machine component or structure by experimental methods. The course introduces the physical principle used by various experimental techniques and provides a guideline to select an experimental technique for a given application. The role of analytical, numerical and experimental methods in solving a problem in solid mechanics are discussed. Stress at a point is discussed in most courses on solid mechanics but little attention is paid on the variation of these quantities over the field of the model. Attention is drawn on the richness of whole field information provided by most of the optical techniques.

The further detailed objectives are as following:

1. To study the physical principle used by various experimental stress analysis techniques.
2. To understand the guideline to select an experimental technique for a particular given application.
3. To understand the variation of stress over the field of the model by various optical techniques.

**Prerequisites Courses:** Mechanics of Solids

**Course outcomes (COs):**

| **On completion of this course, the students will have the ability to:** |
|---|
| CO1 Understand the physics of various experimental stress analysis method. |
| C02 Select an experimental technique for a particular given application. |
| C03 To understand the role of analytical, numerical and experimental methods in solving a problem in solid mechanics |

**Course Topics:**

| Topics | Lecture Hours | |
|---|---|---|
| **UNIT - I**<br>**1. Topic: Introduction to Stress Analysis** | | 10 |
| 1.1 Introduction to Stress Analysis: Analytical and Numerical Approaches | 2 | |
| 1.2 Introduction to Stress Analysis: Experimental Approaches | 2 | |
| 1.3 Optical Methods Work as Optical Computer | 2 | |
| 1.4 Information provided by various experimental methods | 2 | |
| 1.5 Visual appreciation of field information | 2 | |
| **Unit – II**<br>**2. Topic: Strain Gauges** | | 8 |
| 2.1 Principle of Strain Gauges | 2 | |
| 2.2 Overview of Strain Gauge Measurements | 2 | |
| 2.3 Gauge Sensitivity and Gauge factor | 2 | |
| 2.4 Rosette Analysis | 2 | |
| **Unit - III**<br>**3. Topic: Photoelasticity** | | 7 |
| 3.1 Introduction to Photoelasticity | 1 | |
| 3.2 Stress Optic law and compensation techniques | 3 | |
| 3.3 Fringe Sharpening and Multiplication | 1 | |
| 3.4 Separation techniques | 2 | |
| **Unit - IV**<br>**4. Topic: Brittle Coating Technique** | | 5 |
| 4.1 Introduction | 1 | |
| 4.2 Failure theories and coating stresses | 1 | |
| 4.3 Crack pattern and crack detection | 1 | |
| 4.4 Testing of specimen by brittle coating | 1 | |
| 4.5 Calibration of brittle coating | 1 | |
| **UNIT – V**<br>**5. Topic: Morie Fringes Techniques** | | 5 |
| 5.1 Introduction | 1 | |
| 5.2 Principles of Moiré | 1 | |
| 5.3 Strain analysis through Moire fringes | 2 | |
| 5.3 Geometrical & displacement approach | 1 | |
| **UNIT – V I**<br>**6. Topic: Selection of an experimental technique** | | 5 |
| 6.1 Key technologies that have influenced Experimental Mechanics | 2 | |
| 6.2 Multiscale analysis and trends in experimental mechanics | 1 | |
| 6.3 Selection of an experimental technique | 2 | |

**Textbook references (IEEE format):**

**Text Book:**

1. Dally, James W "'Experimental Stress Analysis", McGraw-Hill Book Company, Inc. 2003

**Reference Books:**

1. **Jindal, U.C.** "'Experimental Stress Analysis", Pearson Education India; 1 edition (June 4, 2012)
2. **- Additional Resources (NPTEL, MIT Video Lectures, Web resources etc.):**

**Evaluation Methods:**

| Item | Weightage |
|---|---|
| Quiz 1: 10 | 30 |
| Quiz 2: 10 | |
| Assignments: 5<br>Attendance: 5 | |
| Midterm | 30 |
| Final Examination | 40 |

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