

AIRCRAFT STRUCTURES LABORATORY

Aircraft Structural members include stringers, longerons, ribs, bulkheads, beams and columns. The main structural member in a wing is called the wing spar. The skin of aircraft can also be made from a variety of materials, ranging from impregnated fabric to plywood, aluminum, or composites. To make students aware of various elements of aircraft structural members which are subjected to various loading conditions, this laboratory is equipped with the following facilities.

FACILITIES

STATIC MODEL OF SUKHOI – 30, MK 1

Scale: 1: 6

Length: 12 feet

Wing span: 8 feet with missiles and landing gear

Material: High grade composite



STATIC MODEL OF SUKHOI – 30, MK 1

BEAM TEST SET UP WITH VARIOUS END CONDITION: -

Specification and items available:

- A Sturdy Rigid Frame made of channel construction and designed for supporting Structures Experiments which allows to setup, remove and change experiment modules.
- Two set of Load cells (50 Kg capacity) and digital load indicator with gear box arrangement for fine loading (double side loading)
- A slider arrangement to accommodate 2 dial gauges with magnetic stand for vertical and horizontal deflections
- Different fixtures for mounting different sections of the beam is provided
- Digital micro strain 3-channel strain indicator is provided along with equipment
- Aluminum Sections of: Flat of I", "Square", 'Z' section, 'C' Section, L angle, D section and thickness 3mm with Strain Gauging is provided along with the set up.
- The dimensions of the equipment is 750 mm x 350mm x 1000mm (H)

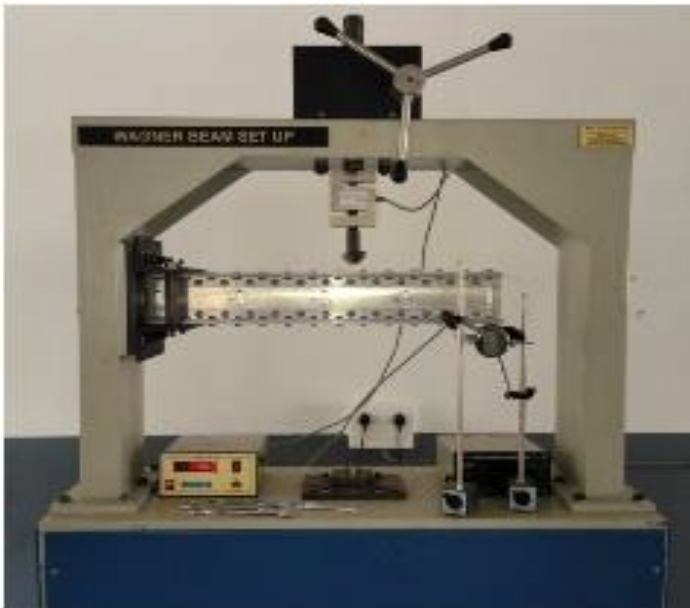


BEAM TEST SET UP

WAGNER BEAM SET UP COMBINED WITH COLUMN TEST PROVISION

Specifications and items available

- A Wagner beam made out of aluminum rivets, of dimension $H = 112 \text{ mm}$, $B = 75 \text{ mm}$, (top) $L = 650 \text{ mm}$ capacity of 5 tons with strain gauging is provided along with the setup
- A sturdy frame with channel construction and gear box arrangement for loading
- A load cell of 5-ton capacity with digital indicator
- 2 Dial Gauges with magnetic stand deflection measurement
- Digital micro strain indicator



WAGNER BEAM SET UP COMBINED WITH COLUMN TEST PROVISION

FABRICATION OF COMPOSITE LAMINATE (VACUUM BAGGING KIT)

Vacuum bag moulding is a modification of hand lay-up, in which the lay-up is completed and placed inside a bag made of flexible film and all edges are sealed. The bag is then evacuated, so that the pressure eliminates voids in the laminate.

Specification and items available:

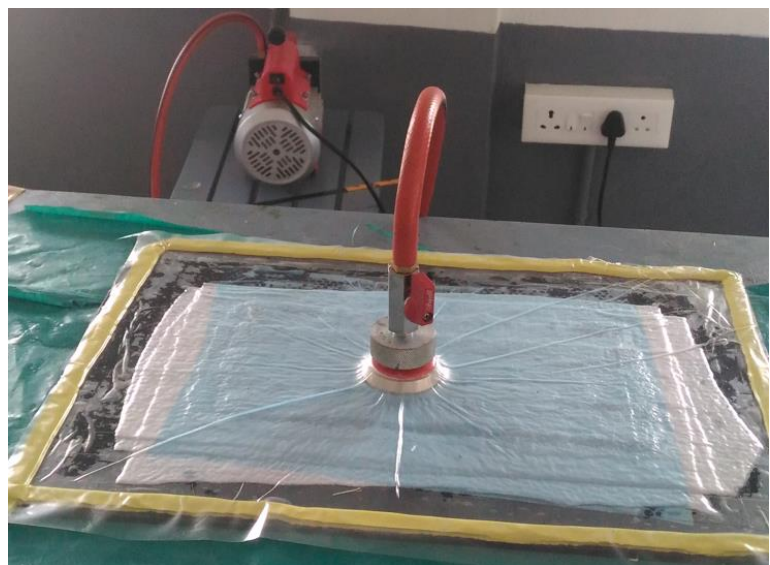
- Vacuum bagging kit (1/4 HP Vacuum Pump and Bagging material)
- **Fabrics available:** Carbon, Kevlar, Glass and Natural Fibers
- Epoxy resin with hardener



Fabrication of Composite Laminate



Carbon Fiber Laminate



Vacuum Bagging Process

NDT (Non- Destructive Testing)

Non-destructive testing (NDT) is a testing and analysis technique used by industry to evaluate the properties of a material, component, structure or system for characteristic differences or welding defects and discontinuities without causing damage to the original part

LPT (Liquid Penetrant Testing)

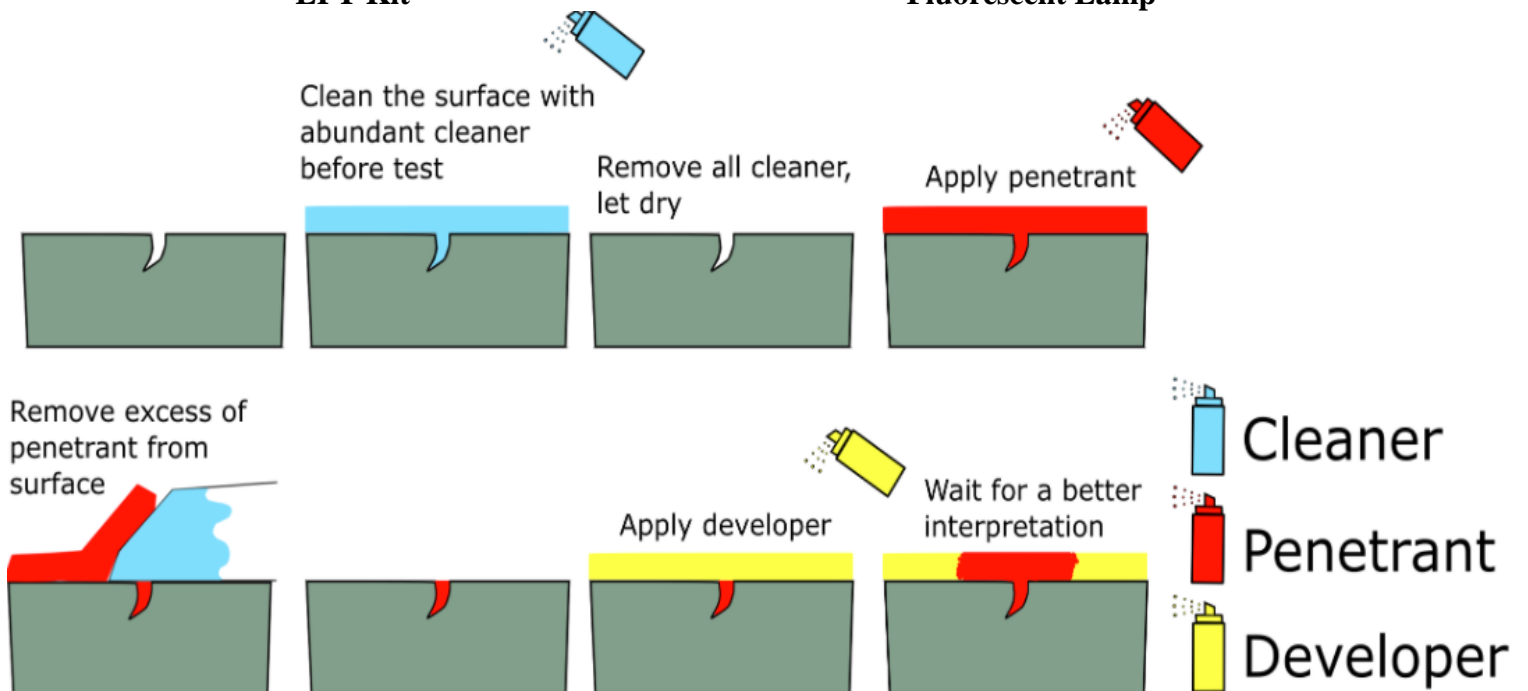
Penetrant testing is based on the capillary action at defects which are open to the surface, as e.g. with cracks, and is a comparably easy examination method: After spraying the testing agent penetrates into the crack due to the capillary action. Then, after the successive intermediate cleaning the developer becomes sprayed on. After drying the developer draws the penetrant from the crack and the indication widens. The trace of the crack becomes visible within a few minutes.

LED based UV lamp is a portable, compact, lightweight & hand-held for testing / inspection applications like fluorescent penetrant testing and fluorescent magnetic particle inspections.



LPT Kit

Fluorescent Lamp



MPT (Magnetic Particle Testing)

Magnetic Particle Testing (MPT), also referred to as Magnetic Particle Inspection, is a nondestructive examination (NDE) technique used to detect surface and slightly subsurface flaws in most ferromagnetic materials such as iron, nickel, and cobalt, and some of their alloys. Because it does not necessitate the degree of surface preparation required by other nondestructive test methods, conducting MPT is relatively fast and easy

Dual Magnetization Yoke is a versatile portable equipment for Magnetic Particle Inspection. By toggling between AC & HWDC, flaws can be detected at the surface and sub-surface levels respectively. Its double jointed legs help contour the equipment easily on to any shape ensuring good contact. With its robust construction, it is handy, light and safe for operators for continuous inspection. It can be used for inspection of various engineering components and welded joints as well.



Dual Magnetic Yoke



Puffer Bulb



Pie Gauge

Ultrasonic Thickness Gauge

Ultrasonic thickness gauge is used for non-destructive investigation of a material's thickness using ultrasonic waves. This equipment is now regularly used across all areas of industrial measurements. Ultrasonic thickness gauges by Olympus can measure a wide range of materials such as plastics, metals, metal composites, rubber and internally corroded materials.



Hot Air Oven

Hot air ovens are electrical devices which use dry heat to sterilize. they use a thermostat to control the temperature. Their double walled insulation keeps the heat in and conserves energy, the inner layer being a poor conductor and outer layer being metallic. This oven is used for curing of composite laminates



SHEAR CENTER SET-UP

This setup is used to determine the shear center of various open and closed channel sections like C-section, I-section, Z-section, L-section etc.,

Specification and items available:

- 2 Dial Gauges with magnetic stand deflection measurement
- Various channel sections



SHEAR CENTER SET-UP

LIST OF EXPERIMENTS:

- Wagner Beam-Tension Field beam
- Verification of Maxwell's Reciprocal theorem
- Verification of Castigliano's theorem
- Verification of Superposition Theorem
- Unsymmetrical Bending of a Cantilever Beam
- Determination of Shear Center of a Channel Section
- Buckling Load of Slender Eccentric Columns
- Determination of Material Properties of a Composite Laminate
- Bending Modulus of a Sandwich Beam
- Non Destructive Testing's (LPT, MPT)
- To determine gyroscopic couple on Motorized Gyroscope
- To find the stability and sensitivity of Watt and Porter governor
- Balancing of rotating and reciprocating masses
- To determine the time period for simple and compound pendulum
- Forced Vibration of Beams