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Physics Lab Equipment

Magnetic Field in Helmholtz Coil

EPCC / PRODUCTS / APPLICATION / SOFTWARE / ACCESSORIES / CONSUMABLES / SERVICES

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Experiments

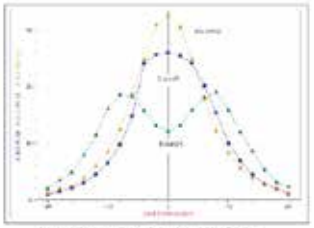
Exp-1 To measure the spatial distribution of the magnetic field between a pair of identical coils in helmholtz arrangement.
Exp-2 To investigate the spacing between coils at which magnetic field is uniform and measure its spatial distribution.
Exp-3 To demonstrate the superposition of the magnetic fields of the two individual coils.

Salient Features

- Digital gaussmeter with axial probe to measure magnetic field.
- Distance between coils is adjusted in U channel bench.
- Easy & simple approach.
- Electrical safety tested.

Key Topics

- Helmholtz coil arrangement.
- Axial hall probe.


Spatial Distribution of the Magnetic Field


Magnetic Field setup in Plane x=0

Principle and Working:

A helmholtz arrangement consists of a pair of identical coils placed symmetrically along a common axis. A fairly uniform magnetic field can be produced in this setup when they are separated by a distance equal to their radius and having equal currents in the same direction flowing through them.

In the present setup, the spatial distribution of the magnetic field of a pair of identical coils in helmholtz arrangement and superposition of the individual fields by the coils is investigated using a digital gaussmeter with axial probe.

Contents:

Item Name
Power supply DC 0-16V, 5 Amp
Digital gauss meter with axial probe
Coil N=390, dia=150mm
Support base
Support rod
Base for helmholtz coil
U channel small
Deflection compass with Base
Axial probe holder
Digital multimeter
Lead 100cm black
Lead 100cm red
Lead 50cm red
Lead 50cm yellow

Specifications

Power Supply 0-16V

Voltage:	0-16V DC continuously variable & stabilized
Voltage display:	3½ digit LED
Ripple:	Less than 25mV
Overload:	Current limiting protection
Current:	5 A continuously variable, 10% to full rating
Current display:	3½ digit LED
Working voltage:	230V AC, 50 Hz single phase

Digital Gauss Meter

Range:	200 G & 2 kG
Resolution:	1G at 0 - 200G
Offset:	By Potentiometer to set ZERO
Display:	3½ Digit LED
Power:	220 V, ±5%, 50 Hz AC
Axial Hall probe:	InAs

Base for Helmholtz Coil & Coil Sets

COIL SETS SV628

Coil:	Dia=150mm, N=390,
Current:	1Amp (max.)
Connection:	4mm safety socket
Material:	Copper

BASE FOR HELMHOLTZ COIL

U channel dimension:	350x210x25mm (LxWxH)
Scale:	0-22cm, least count=1mm
Material:	Aluminium

U Rail with Rider

U rail dimension:	725x60x15mm (LxWxH)
Scale:	0-50cm, least count=1mm
Rider:	60x60mm (LxW)
Material:	Aluminium

Deflection Compass with base

Compass Box:	100mm dia.
Rider:	150x60mm (LxW)
Material:	Aluminium

Support Base & Support Rod

	Dimension	Material
Base	160x100mm (LxW)	Mild steel
Rod	250x10mm (LxΦ)	Mild steel
	Threading M10	

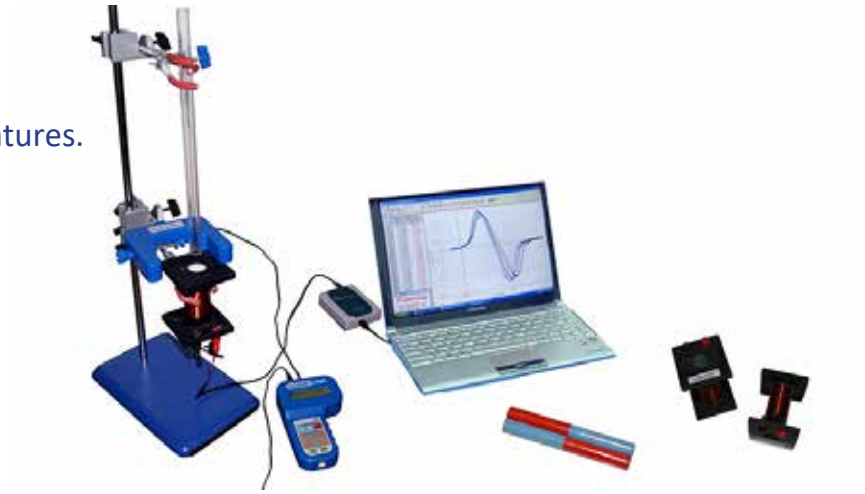
Faraday Law & Induced E.M.F

Experiments

Exp-1 Verification of Faraday and Lenz's law of induction by measuring the induced voltage as function of time.
Exp-2 Measurement of the induced voltage impulse as a function of the velocity of the magnet.
Exp-3 Calculation of the magnetic flux induced by the falling magnet as a function of the velocity of the magnet.

Salient Features

- Multipurpose data logger.
- Easy setup with advanced software features.
- Microcontroller based digital timer.



Key Topics

- Faraday & Lenz's law.
- Induced E.M.F.
- Magnetic flux.
- Free fall.

Principle and Working:

An induced e.m.f. (or induced current) is produced across a conductor when it is exposed to a change in a magnetic field. The mathematical law that relates the changing magnetic field to the induced current (or the induced voltage) is called Faraday's Law. Lenz's law describes the magnetic flux through the circuit and gives the direction of the induced e.m.f. This gives rise to induced current which opposes the change in magnetic flux.

In the present setup, a permanent magnet falls with different velocities through a coil, the change in the magnetic flux generates an induced voltage impulse. The induced voltage impulse is recorded with voltage probe through a computer interface system Einstien Lab-Mate+. Depending on the polarity of the permanent magnet the induced voltage impulse is negative or positive.

Contents:

Item Name
Einstien LabMate+
Einstein Voltage Sensor
Support Base
Support Rod
Three Fingle Clamp
Bosshead
Coil N=700, L=75mm, Dia=32mm
Coil N=1150, L=75mm, Dia=32mm
Cylindrical Magnet
Tube 300mm
Digital Timer
Photogate

Specifications

Einstien LabMate+

Sampling Rate: Up to 100 ksps
Internal memory capacity: 250k samples
Sampling Resolution: 12 bit
Data analysis Software: MiLAB/MultiLab
External Sensor: +65
Battery(Lithium polymer; 1000mAh): Rechargeable via USB

Digital Timer & Photogate

Display: 2 line LCD
Type: Micro controller based
Time resolution: 0.1 milli second
Mode: Time, Speed & Acceleration
Photogate: 2 Nos.
Interface: USB
Operating voltage: 5V DC
Photogate detector: Infra-Red

Coil Sets

SWG	L(mm)	N	R(Ω)	L(mH)	I(A)max
30	75	700	19	13.8	0.3A
26	100	1150	13.5	8.8	0.7A

Einstein Voltage Sensor

Plastic Tube

Tube size: 300x11mm (LxI.D)
Material: Acrylic

Cylindrical Magnet

Dimension: 50x10mm (LxΦ)
Material: Alnico

Universal Clamp

Material: Aluminium alloy
Tightening screw: 'T' type plastic knob
Rod: Aluminium length=160 mm
Object: Holds up to 75mm diameter.

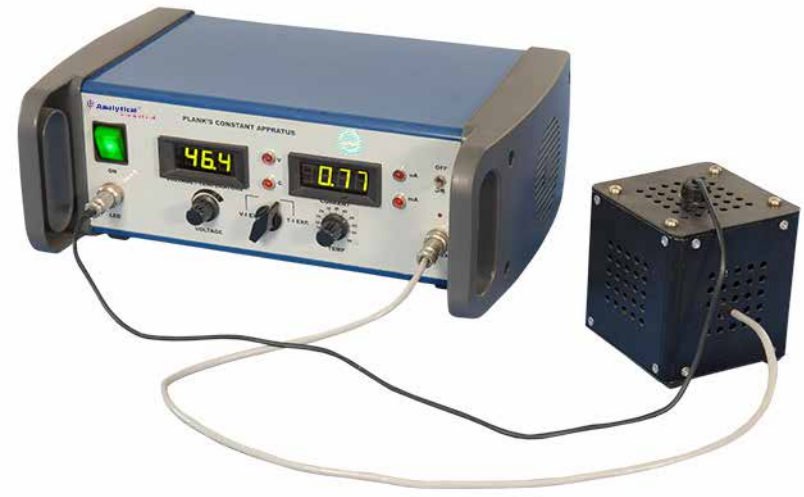
Bosshead

Object type: Square & round shape
Object size: Up-to 13mm dia
Material: Aluminium alloy
Object can be held both vertically and horizontally.

Support Base & Support Rod

	Dimension	Material
Base	250x160mm (LxW)	Mild steel
Rod	1000x12.5mm (LxΦ) Threading M10	Mild steel

Planck's Constant by LED



Experiments

Exp-1 Determination of material Constant h.
Exp-2 Determination of Temperature Coefficient of Current.
Exp-3 Determination of Planck's Constant by LED method.

Salient Features

- It is a self contained unit.
- Using LED method instead of photocell & monochromatic light source reduces cost.
- Built - in power supply for Oven (oven ambient to 60°C, resolution 0.1°C).
- Variable voltage source 0 - 2V DC, resolution 1mV.
- Current meter 0-20mA / 2000mA.
- In - built temperature sensor.

Key Topics

- Photoelectric effect.
- Photo cell.
- Work function.
- Planck's constant.
- Photoelectric voltage.
- Photon energy.

Principle and Working:

The photon energy by Einstein equation E=hv is equal to energy gap Eg between the valence and conduction bands. The energy Eg is equal to the energy barrier eV0, that electron have to overcome in going from n-doped side of diode junction to p-doped side when no external voltage V is applied to the diode.
In the p-doped side, electron recombine with holes releasing the energy Eg in the form of photon is given by equation

$Eg = eV_0$

In the present setup ,the Planck Constant is given by

$$h = \frac{eV_0\lambda}{c} \quad \text{Where,} \quad V_0 = V - \left[\frac{\Delta \ln I}{\Delta T^{-1}} \text{X} \frac{k}{e} \text{X} \eta\right]$$

Contents:

Planck’s constant apparatus
Oven
LED red
LED yellow

Specifications

Planck's Constant Apparatus

Selector Switch: V-I and T-I experiment

Selector Switch at V-I position :-

Voltmeter Display: 3½ digit, 7segment LED,auto polarity & decimal indication.
Voltage Range: 0.000-2.000V
Current Display: 3½ digit, 7segment LED
Current Range: 0-2000mA

Selector Switch at T-I position :-

Current Display: 3½ digit, 7segment LED
Current Range: 0-20mA
Temperature Display: 3½ digit, 7segment LED
Temperature Range: Room temperature to 60.0°C

Oven: Heater pin 4 & 5. Temperature pin 1 & 2
Oven Connector: 5 Pin, DIN type
LED Connector: 3 Pin, DIN type
Input Voltage: 220V, 50Hz AC
Fuse: 1A, 250 V

Oven With Temperature Sensor

Heating Element: 20 ohm
Oven Connector: 5 Pin, DIN type
Ambient Temperature: 60° C
Temperature Sensor: Pt100
Output Pin: Heater pin 4 & 5. Temperature pin 1 & 2

Optical Fiber Kit

Experiments

Exp-1 Calculate the numerical aperture and study the losses that occur in optical fiber cable.
Exp-2 To study losses at FIBER junctions.
Exp-3 To measure losses in dB of two optical FIBER patchcords and the coefficient of attenuation.
Exp-4 To study the relationship between the LED forward current and the LED optical power output.
Exp-5 To study the relationship between the optical input power, and the resultant photo current.
Exp-6 To study the AC characteristics of a linear intensity modulation system.
Exp-7 To study external circuitry to transmit an audio signal through an optical FIBER using the analogue transmitter and receiver.

Salient Features

- In-built function generator.
- Separate transmitter & receiver section.
- Microphone input section.
- Audio amplifier output section.
- Fiber cable 1m and 5m PMMA.
- In line SMA adaptor.

Key Topics

- Fiber communication.
- Numerical aperture.
- Photo detector.
- Photo transistor.
- Optical losses.
- Conversion efficiency.
- Intensity modulation system.
- Audio signal.
- Coefficient of attenuation.

In order to understand the fundamental of optical fibers and analogue optical fiber communication, this kit has been designed. Wiring diagram for Fiber Optic Analogue Transmitter, Fiber Optic Analogue Receiver, Fiber Optic LED Driver and Optical Power Meter has been shown on the panel of kit.

In the present setup, eight experiment can be performed by using this trainer. The user can design a number of other interesting experiments and small projects based on the kit. Provided with detailed instruction manual.

Contents:

Item Name
One - meter PMMA Fiber Patchcord
Five meter PMMA Fiber Patchcord
In -Line SMA Adaptor
Mandrel
Numerical aperture measurement Zig
Fibre optics Trainer
Speaker
Mike
Circular ring screen
Connecting leads

Newton's Rings Experiment Kit

Newton's Rings View

Experiments

Exp-1 To determine the wavelength of sodium light.
Exp-2 To determine the refractive index of a liquid by using Newton's rings apparatus.
Exp-3 To find the radius of curvature of planoconvex lens using Newton's rings experiment, given λ=5893A°.
Exp-4 To find the thickness of a thin sheet of paper (air wedge experiment).

Salient Features

- All the components including sodium lamp, microscope, power supply & optics are housed in single piece compact body (stand alone setup).
- Optical glass plate mounted at 45° (no adjustment required).
- Smooth moving collimating facility.
- Quick adjustment, good quality, well defined distinct fringes.

Key Topics

- Interference.
- Newton's rings.
- 4Refractive index.
- Air-wedge method.
- 4Radius of curvature.

Principle and Working:

A plano-convex lens is placed with its convex surface on the optically plane glass plate so as to enclose a thin film of air of varying thickness between the lens and the plate. Light from an extended monochromatic source is converted into a parallel beam of light by using a convex lens of short focal length and made to fall on an optically plane glass plate inclined at an angle of 45° to the vertical, where it gets reflected on to the Plano-convex lens. The wavelength of monochromatic light source is determined from the radii of the interference rings.

Contents:

Newton's ring apparatus
Spherometer
Plano convex lens with plane glass plate

Specifications

Newton's Rings Apparatus

Dimension: 390 x 480 x 170mm approx.
Micrometer: 0.01 mm least count
Eyepiece: Ramsden 10X
Objective: 3x
Weight: 12.6 kg approx.

Spherometer (Disc Brass)

Type: 3 legs
Verticale Scale: 6mmx6mm (WxT)
Micrometer: Dia. 40mm, Brass
Lower Disc: dia. 60mm
Range: 10-0-10mm
Least Count: 0.01mm

Plano Convex Lens

Dia.: 61.5mm, Glass
Focal Length: 200mm

Characteristics of P-N Junction Kit

Experiments

Exp-1 Determination of reverse saturation current.
Exp-2 Study of Energy Band Gap of p-n Junction.
Exp-3 Study of Junction capacitance.

Salient Features

- Suitable for Diodes, Transistors.
- Built - in current source, bias voltage generator.
- Built - in power supply for oven.

Key Topics

- Saturation current.
- Energy band gap.
- Temperature coefficient.
- Junction capacitance.

Principle and Working:

The slope of V-T curve used to measure the temperature coefficient of the junction voltage and the energy band gap is given by

$$V_{G0} = V(T) - T.\frac{dV}{dT} - \frac{m\eta kT}{q}$$

Where V(T) - Voltage at given temperature, dV/dT - Slope of curve, for Si, m = 1.5, η=2 at 300K and for Ge, m = 2, η=1 at 300K, η - Material constant and q - charge of electron.

Contents:

Specifications

P-N Junction Setup

Selector Switch: V-I and V-T experiment, Bias & Junction

Selector Switch at V-I position/Junction :-

Voltmeter Display: 3½ digit, 7segment LED, auto polarity
Voltage Range: 0.000-1.999V
Current Display: 3½ digit, 7segment LED
Current Range: 0-20mA

Selector Switch at V-T position/Junction :-

Voltage Display: 3½ digit, 7segment LED
Voltage Range: 0.000-1.999V
Temperature Display: 3½ digit, 7segment LED
Temperature Range: 273K to 353K

Oven With Temperature Sensor

Heating Element: 35 ohm
Oven Connector: 5 Pin, DIN type
Ambient Temperature: 353K
Temperature Sensor: Pt100
Output Pin: Heater pin 4 & 5. Temperature pin 1 & 2

Junction Transistor

Transistor: NPN
Type: BC109
Connector: 4mm Plug-in Socket

Diode

Diode: P-N Junction
Type: IN5402

Variable 'g' Pendulum

Experiments

Exp-1 To investigate the oscillation behaviour of a pendulum (rod pendulum) by varying the magnitude of the components of the acceleration due to gravity.
Exp-2 Measure the period T for various pendulum lengths L.

Salient Features

- Hand-held digital timer with data logging facility & membrane keypad.
- Small slits on the inside edge of the photogate for emitting & receiving infra red beam.
- Many other experiments can also be performed with the same timer.
- Quick & accurate results.

Key Topics

- Oscillation period.
- Harmonic oscillation.
- Mathematical pendulum.
- Physical pendulum.
- Decomposition of force.
- Moment of inertia.

Principle and Working:

The pendulum used here can act as a mathematical (simple) pendulum. However, depending on the position of the pendulum weight, the length measured between the pivot point and the centre of the moveable weight can be varied.

In the present setup one can rotate the oscillation plane around the angle θ with respect to the vertical plane thus altering the value of 'g'. The time period of oscillation at angle θ is given as:

$T(\theta) = 2\pi(L/ geff)^{1/2}$

where **$geff = g.\cos\theta$**

Contents:

Item Name
Bar pendulum
Bar pendulum holder
Circular disk
Digital timer
Photogate
Mounting rod
Support base
Support rod
Boss head

Specifications

Circullar Disk

Material: PVC
Diameter: 150mm
Thickness: 15mm
Hole thread: M6

Bar Pendulum Holder

Material: PVC
Bearing: Ball type 13mm dia.
Dimension: 14x25x20 (LxWxT)

Bar Pendulum

Terminal: Mild Steel
Rod: 360x10mm (Lxdia.)
Weight: 30x10mm(Outer x Inner dia.)

Mounting Rod

Material: Mild Steel
Input voltage: 400 x 10 mm (L x dia.).
Thread-M6

Support Base & Support Rod

	Dimension	Material
Base	250x160mm (LxW)	Mild steel
Rod	1000x12.5mm (LxΦ) Threading M10	Mild steel

Digital Multimeter

Input Limits	
Function	**Maximum Input**
V DC or V AC	1000V DC /VAC
A DC/AC	10A DC/AC (30 sec. max every 15 minutes)
Frequency, Resistance, Capacitance, Duty Cycle, Diode test, Continuity	600V DC/AC
Temperature	600V DC/AC

General Specifications

The instrument complies with: EN61010-1.
Insulation: Class2, Double insulation.
Overvoltage category: CATIII 600V, CATII 1000V.
Display: 6000 counts LCD display with function indication.
Polarity: Automatic, (-) negative polarity indication.
Overrange: "OL" mark indication.
AC Response: True RMS (50 Hz or 60 Hz)
True RMS: The term stands for “Root-Mean-Square”, which represents the method of calculation of the voltage or current value. Average responding multimeters are calibrated to read correctly only on sine waves and they will read inaccurately on non- sine wave or distorted signals. True rms meters read accurately on either type of signal.
Low battery indication: The ' ' is displayed when the battery voltage drops below the operating level.
Measurement rate: 2 times per second, nominal.
Auto power off: Meter automatically shuts down after approx. 15 minutes of inactivity.

Operating environment: 0ºC to 50ºC (32 ºF to 122 ºF) at < 70% relative humidity.
Storage temperature: -20ºC to 60ºC (-4 ºF to 140 ºF) at < 80% relative humidity.
For inside use, max height: 2000m
Pollution degree: 2
Power: One 9V battery , NEDA 1604, IEC 6F22.
Dimensions: 150 (H) x 70 (W) x 48 (D) mm
Weight: Approx.: 255g.
Hold : To freeze displayed data
Max/Min : To record max/min values

Technical Specifications

Accuracy is given at 18ºC to 28ºC (65ºF to 83ºF), less than 70% RH

DC Voltage

Range	Resolution	Accuracy
600.0mV	0.1mV	±0.5% of rdg + 2 dgts
6.000V	1mV	±1.2% of rdg + 2 dgts
60.00V	10mV	
600.0V	100mV	
1000V	1V	±1.5% of rdg + 2 dgts

Input Impedance: 7.8MΩ.
Maximum Input: 1000V DC or 1000V AC rms.

AC Voltage (T-RMS)

Range	Resolution	Accuracy
6.000 V	1mV	±1.5% of rdg ±10 dgts
60.00 V	10mV	
600.0 V	100mV	
1000V	1V	±2.0% of rdg + ±10 dgts

Input Impedance : 7.8MΩ.
Frequency Range : 50 to 60Hz
Maximum Input: 1000V DC or 1000V AC rms.

DC Current

Range	Resolution	Accuracy
6A	1mA	±2.5% of rdg ± 5 dgts
10A	10mA	

Overload Protection: 10A / 250V Fuse.
Maximum Input: 10A DC or AC rms on 10A DC range.

AC Current (T-RMS)

Range	Resolution	Accuracy
6A	1mA	±3.0% of rdg ± 5 dgts
10A	10mA	

Overload Protection : 10A / 250V Fuse.
Frequency Range : 50 to 60 Hz
Maximum Input: 10A DC or AC rms on 10A AC range.

Resistance

Range	Resolution	Accuracy
600.0Ω	0.1Ω	±1.2% of rdg + 4 dgts
6.00kΩ	1Ω	±1.0% of rdg + 2 dgts
60.00kΩ	10Ω	±1.2% of rdg + 2 dgts
600.0kΩ	100Ω	
6.000MΩ	1kΩ	±2.0% of rdg ± 10 dgts
60.00MΩ	10kΩ	±5.0% of rdg ± 10 dgts

Maximum Input : 600V DC or 600V AC rms.

Capacitance (Auto-ranging)

Range	Resolution	Accuracy
40.00nF	1pF	±5.0% of rdg±50 dgts
400.0nF	0.1nF	±3.0% of rdg ±5 dgts
4.000uF	1nF	
40.00uF	10nF	
400.0uF	0.1uF	±5.0% of rdg ±5 dgts
4000uF	1uF	

Maximum Input : 600V DC or 600V AC rms.

Diode Test

Test current	Resolution	Accuracy
0.3mA typical	1 mV	±10% of rdg ± 5 dgts

Open circuit voltage : 1.5V DC typical
Overload protection : 600V DC or AC rms.

Frequency (Auto-ranging)

Range	Resolution	Accuracy
9.999Hz	0.001Hz	±1.5% of rdg ±5 dgts
99.99Hz	0.01Hz	
999.9Hz	0.1Hz	±1.2% of rdg ±3 dgts
9.999kHz	1Hz	
99.99kHz	10Hz	
999.9kHz	100Hz	
20MHz	1kHz	±1.5% of rdg ±4 dgts

Sensitivity: >0.5V RMS while≤ 1MHz ;
Sensitivity: >3V RMS while >1MHz ;
Overload protection : 600V DC or 600V

Duty Cycle

Range	Resolution	Accuracy
0.1%~ 99.9%	0.1%	±1.2% of rdg ±2 dgts

Pulse width: >100us, <100ms;
Frequency: 5Hz - 150kHz
Sensitivity: >0.5V RMS
Overload protection: 600V DC or 600V AC rms.

Temperature

Range	Resolution	Accuracy
-20ºC~+ 760ºC	1 ºC	±3% of rdg
-4 ºF~+ 1400 ºF	1ºF	±5 ºC/9ºF

Sensor: Type K Thermocouple
Overload protection : 600V DC or AC rms.

Audible continuity

Audible threshold: Less than 100Ω;
Test current: < 0.3mA
Overload protection : 600V DC or AC rms.

Diode Characteristics

Experimental Training Board has been designed specifically for plotting the forward and reverse bias characteristics of a Germanium semiconductor Diode, and a Zener Diode. The board is absolutely self contained and requires no other apparatus.

Practical experience on this board carries great educative value for Science and Engineering Students.

Object:

01. To study and plot the forward & reverse bias characteristics of a Germanium semiconductor Diode.
02. To study and plot the forward & reverse bias (breakdown) characteristics of a Zener Diode.

Features:

The board consists of the following built-in parts :

01. 0-10V D.C. at 10mA, continuously variable regulated Power Supply with low ripple & hum and integral current limiting resistor.
02. Digital Voltmeter DC 3½ Digit Having Dual range of 2V / 20V.
03. Digital Current meter DC 3½ Digit Having Dual range of 20mA / 20mA
04. A Germanium semiconductor Diode mounted behind the panel.
05. A Zener Diode mounted behind the panel.
06. Adequate no. of other electronic components.
07. Mains ON/OFF switch, Fuse and Jewel light.

* The unit is operative on 230V ±10% at 50Hz A.C. Mains.
* Adequate no. of patch cords stackable from rear both ends 4mm spring loaded plug length ½ metre.
* Good Quality, reliable terminal/sockets are provided at appropriate places on panel for con nections / observation of waveforms.
* Strongly supported by detailed Operating Instructions, giving details of Object, Theory, Design procedures, Report Suggestions and Book References.

Experiment for liner Motion

Linear uniform motion with Cobra DigiCart Principle

Acceleration is one of the basic concepts of the theory of motion. It indicates how fast an object changes its speed and is measured in the unit m/s^2. The concept of acceleration is based on the average acceleration as the quotient of the change in speed in a given period of time.

Function Generator

Function Generator can generate multiple waveforms such as sine wave, square wave, triangle wave, pulse wave, and arbitrary wave. The frequency range up to 15MHz with duty cycle adjustment, sweep frequency, frequency signal frequency and counter function, and the output signal, amplitude, and frequency can be simultaneously. The series signal generator has excellent amplitude and frequency characteristics, the appearance of this instrument is exquisite and beautiful.

Technical Specifications

Display	Display type	2.4 inch TFT color LCD display
Store and load	Quantity	100
	Position	00 to 99 (00 memory location parameter is loaded by default as power on)
Arbitrary wave	Quantity	1 to 60 total 60 groups (15 groups by default as power on)
Interface	Interface mode	USB to serial interface
	Extension interface	With TTL level mode serial interface for user secondary development
	Communication speed	Adopt standard 115200 bps
	Protocol	Using the command line, the protocol is made public
Power supply	Voltage range	DC5V±0.5V
Manufacturing technology	Surface mount technology, large-scale integrated circuits, high reliability, long service life	
Prompt tone	Users can turn on or off by setting program	
Operating characteristics	All key operations, knob continuous adjustment	
Environmental conditions	Temperature: 0~40 °C Humidity: <80%	

LCR Resonance Circuit

LCR Resonance Trainer is unique product that provides a complete learning content for both Series and Parallel Resonance. Resonance is an interesting phenomenon in electrical circuits in which Inductive and Capacitive elements behave to make a Zero Impedance circuit. This explanation is given with the help of Passive circuits on the Trainer.Multiple combination of components has been provided so that students can calculate Resonance Frequencies for different combinations. Concept of Resonance Frequency is explained very clearly which can be easily seen either on Oscilloscope or on the board display.

Features

- LCD Voltmeter and Frequency Counter
- Inbuilt Signal Generator
- Low cost trainer demonstrating both Series and Parallel Resonance
- Experiments can be performed with or without Oscilloscope
- Inbuilt power supply
- Extensive E-Manual

Technical Specifications

Mains Supply	: 90 - 275 V, 50 / 60 Hz
Generator Output	: 8Vpp
Frequency Ranges	: 1 KHz, 10 KHz, 60 KHz
Voltmeter	: 2V

Scope of Learning

Study of Series L-C-R Resonance and to determine its Resonance Frequency.
Study of Parallel L-C-R Resonance and to determine its Resonance Frequency.

Solar Cell Characteristics

Experimental Set-Up has been designed specifically to study the characteristics of a Solar Cell. The set up consists of board with intensity controller, mounted solar cell, table lamp 100W and five different area choppers. The set-up is complete in all respects and requires no other apparatus. Practical experience on this set up carries great educative value for Science and Engineering Students.

OBJECT

To study the followings :
01 Illumination characteristics.
02 Current voltage characteristics.
03 Power-load characteristics.
04 Areal characteristics.

FEATURES

The complete Experimental Set-up consists of the followings :
01 One board built-up of
- 1.1 Digital D.C.Ammeter dual range, 3½ digit 7 segment display.
- 1.2 Digital D.C.Voltmeter dual range, 3½ digit 7 segment display.
- 1.3 Digital D.C.Voltmeter 3½ digit 7 segment display.
- 1.4 Socket for table lamp with intensity control
- 1.5 Nine different resistance values selected by a band switch.

02 Solar Cell mounted.
03 Table Lamp 100 watt.
04 Five different area choppers.
05 Weight :3.8 Kg. (Approx.)
06 Dimension : W 340 x H 125 x D 210
07 The unit is operative on 230V ±10% at 50Hz A.C. Mains.
08 Adequate no. of patch cords stackable 4 mm spring loaded plug length 50cm.
09 Good Quality, reliable terminal/sockets are provided at appropriate places on panel for connections & observation of waveforms. 10 Strongly supported by detailed Operating Instructions, giving details of Object, Theory, Design procedures, Report Suggestions and Book References.

Soldering Machine

De-Soldering Station

Specifications:
Input Voltage: 190 V to 270V
Output Voltage: 24V AC
Wattage: 70 Watts
Temp range: 180-480°C
Temp Accuracy: ± 1°C
Tip to ground potential: Under 2M.V
Tip to ground Leakage: Under 2
Vacuum: 600 mm/Hg.
High Quality 24V DC Pump with 4000 RPM

Accessories:
01. Control Unit ---------- 1No.
02. Soldering Iron---------- 1No.
03. Dc-Soldering Iron ---------- 1No.
04. Combined Soldering &
De-SolderingStand---------- 1No.
05. Power Cord---------- 1No.

Tool Box Containing:
01 Primary Filter ---------- 15No.
02. Secondary Filters---------- 5No.
03. Silicon Washer Set ---------- 1No.
04. Glass Tube---------- 1No.
05. Nozzle Cleaning Spring ---------- 1No.

Soldering & De-Soldering Station

Specifications:
Input Voltage: 190V to 270C
Output Voltage: 24VAC
Soldering Voltage: 60 Watts
De-Soldering Vattage: 70 Watts
Temp Range: 180- 480°C
Temp Accuracy: ± 1 °C
Tip to ground potential: Under 2MV
Tip to ground Leakage: Under 2
Vacuum: 600mm/Hg
High Quality 24V DC Pump with 4000 RPM

Accessories:
01. Control Unit---------- 1No.
02. Soldering Iron---------- 1No.
03. Dc-Soldering Iron---------- 1No.
04. Combined Soldering &
De-Soldering Stand---------- 1No.
05. Power Cord---------- 1No.

Tool Box Containing:
01 Primary Filter ---------- 15No.
02. Secondary Filters ---------- 5No.
03. Silicon Washer Set ---------- 1set.
04. Glass Tube ---------- 1No.
05. Nozzle Cleaning Spring ---------- 1No.

Jib Crane Apparatus

This unit is designed to study forces in jib crane elements. Jib crane has two elements which are attached to a vertical rod. The lower element is called jib and the upper element is termed as tie. Load is applied at the junction of jib and tie to produce tension and compression in tie and jib respectively.

The unit consists of a metallic rod which provides the support locations for jib and tie. Load is applied via a hanger on the junction of jib and tie. To measure the deformation in jib and tie, dial gauges are connected to both elements.

a planar central force system in which multiple forces act on a single point of application. Based on the example of a crane jib, forces are determined graphically and experimentally: resultant cable force, tensile force, compressive force. The directions and magnitudes of the forces are determined graphically by way of a force parallelogram.

A bar of adjustable length and a chain make up the crane jib, which is attached by adjustable clamp elements to a retaining bar. A variety of jib forms can be created. Loads are applied to the crane jib. The occurring bar forces are indicated by integrated spring balances.

Learning Objectives / Experiments

– Graphical breakdown of forces by force parallelogram

– Determination of the bar forces on various jib forms

– Comparison of: measurement result – calculation – graphical method

Specification

[1] Tensile and compressive forces in a planar central force system based on the example of a crane jib

[2] Various jib forms possible

[3] Integrated spring balances in the bars

[4] Max. load on crane jib 50N

[5] Loading with weights set, up to 50N

[6] Steel weights, surfaces galvanized

[7] Stainless steel retaining bar

[8] Sturdy metal frame

[9] Handles to aid transportation

[10] Box to house the components

Technical Data

Spring balance for tensile forces

– tensile force: 0…50N, graduations 0.5N Spring balance for compressive forces

– pressure force: 0…50N, graduations 1N Weight set

– 1x 1N (hanger)

– 4x 1N

– 1x 5N

– 4x 10N

Dimensions and Weight

l x w x h: 600 x 200 x 670 mm
Weight: approx. 15 kg

Pulley Demonstration Set

Descriptions:
Stands 32 inches high with a 7.8 inch wide base for sturdy display.

Demonstrate a variety of physics concepts – beginner to advanced.

Right-angled clamps support horizontal rod on which pulleys hang.

Collars with hooks can be inserted onto rod to support pulleys.

Capstan fitted onto one end of the sturdy metal base; hook for attaching pulley at other end.

A highly versatile apparatus for the demonstration of various concepts associated with pulleys and their configurations. Demonstrate multiple configurations simultaneously or concentrate on one topic.

Built to last for years in the classroom with a sturdy metal base and quality-made steel rods. Easy to use, designed for students learning the basics of mechanical advantage with pulley applications. The variety of included pulleys and accessories make it the ideal pulley demonstration tool.
Demonstrate mechanical and force differences between a single pulley and double pulley, determining the work/energy of a pulley system, or interface with computer sensors (not included) to perform similar activities.

Includes

- Pulleys – (8) single, (2) triple tandem, (2) quadruple
- Wooden base – 81 x 20 cm fitted with 2 sockets, a capstan and an eye hook.
- (3) Rods (diameter 12.5 mm and length 81 cm)
- (8) Collars with hook
- (3) Right angled clamps
- (1) Wheel & axle
- Cord – 4 roll
- (1) Tommy bar for tightening vertical rods
- Slotted brass mass set (2x10g, 2x20g, 2x50g, 4x100g, 4x200g, 1x500g)
- Brass weight hangers set (5x50g, 1x20g, 1x10g)

Rotational Moment of Inertia Apparatus

Descriptions:

Moment of inertia is a physical quantity for the representation of the inertial amount of a rotational object. It is dependent on the mass distribution and the shaft position of the rigid body.

This apparatus uses the three-string pendulum method to determine the moment of inertia of a rigid body. A photoelectric sensor combined with a time counting device is used to measure the torsional oscillation period of a hanging plate. Through the experiments, students can understand the physical principle of the moment of inertia and learn the measurement method with factors related to the amount of moment of inertia.

Using this apparatus, the following experiments can be conducted:

1) Measure the moment of inertia using the three-string pendulum method.
2) Measure the moment of inertia of two objects of same mass but with different mass distribution.
3) Verify the parallel axis theorem of moment of inertia.

Torsional Vibrational Apparatus

This bench top mounted unit is used to study torsion and torsional vibration in experiments. The apparatus is constructed around a profiled aluminium base with leveling feet, onto which is mounted 4 vertical chuck pillars. Each pillar contains a central shaft running in precision bearings with a chuck at one end which grips a torsion specimen. Each chuck also contains a large disc of varying mass and inertia. With these chucks it is possible to assemble a torsion specimen with up to 3 masses.

Vibrations are transmitted into the torsion specimen by means of an exciter, which is electronically speed controlled from the main control unit. To change the end conditions of the apparatus a fifth chuck houses a chuck which rigidly clamps the end of the torsion specimen to achieve a fixed end. Also supplied with the apparatus is a manual torsion arrangement, which allows a known angular twist to be applied to the specimen. A cord is wrapped around one of the large discs and a load is applied via a hanger and weights set. The angle of twist for incremental loading is recorded and the modulus of rigidity can be calculated.

Oscillations sensors are mounted integrally with each mass pillar and provide signals of the amplitude of vibration. The control unit conditions these signals and makes them available to an oscilloscope (not supplied) for vibration analysis.

Unit for investigating torsional vibration and torsional stiffness

Observation of resonance, phase change

To be made from profiled aluminum with levelling feet at each corner

To have steel torsion bar, corrosion-resistant, 1300mm long, Ø6mm with torsional mass discs of Ø150mm and Ø228mm

4 movable chuck pillars with integral bearings, the bearing units can be positioned as required

To have speed-controlled exciter with drive crank

Angular movement of shaft recorded using oscillation sensors

Electronic exciter control unit with digital display

Torsion arrangement for modulus of rigidity experiments

Universal Force Table

It consists of cast aluminum plate of 400 mm dia. graduated in 360 degrees. The table is fitted on a case iron stable base with leveling screws to make the table in leveled position. It is possible to fix the table in any desired position. Supplied will six set of brass nickeled slotted weight each set containing nine weights and one hanger of 50 grams. And is complete with six sliding clamping pulleys to fix up the same.

DIMENSIONS AND WEIGHT: Size :0.5 m.(L)x 0.5 m(W) X 0.5 m (H)

Weight :Approx. 4 Kg

Winch Cab Single Purchase Apparatus

The grooved wheel is of 25 cm dia and gears are machine cut.

Winch crab single purchase- Fitted with heavy cast iron wall brackets.

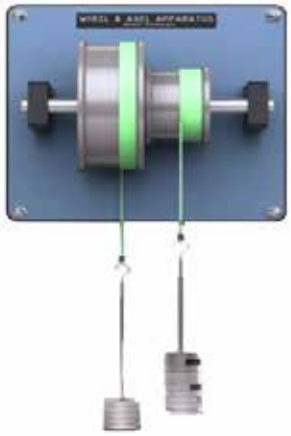
Winch crab Double purchase- Same as above but with double set of gearing arrangement.

Worm And Wheel Apparatus

Worm Wheel is an all metallic self-contained apparatus useful for demonstrating the efficiency of worm and wheel and also the principle of work. The equipment consisting of a machine cut worm gear of 25 cm diameter, carrying a metal drum of 12 cm diameter and machine cut worm on steel spindle carrying a 12 cm diameter pulley. The whole arrangement is fixed on heavy cast iron brackets capable to be fixed to a wall. The Worm Wheel comes complete with effort pulley, string and hook but without weights.

Single Purchase, Double Purchase, Triple Purchase

Wheel And Axle Apparatus



The model demonstrates the conditions of equilibrium on a differential pulley block. Three anodised aluminium pulleys of different diameter are fitted to a shaft mounted on ball bearings. The forces act, on the one hand, directly on the peripheral of the largest pulley, on the other hand, via a loose pulley on two smaller pulleys. Easy to interchange weights permit the load to be varied such that equilibrium is obtained. The model is intended for wall mounting.

Learning Objectives / Experiments

– Equilibrium of forces

– Equilibrium of moments

– Relationship between force reduction and cord travel

Specification

[1] Experiment on the equilibrium of forces and moments on a differential pulley block

[2] 3 pulleys made of anodised aluminium

[3] 2 sets of weights

[4] Ball bearing mounted steel shaft

[5] Anodized aluminum base plate

Pulley diameter

– D=250mm

– D=100mm

– D=50mm

Loose pulley

– D=75mm

Set of weights:

– 2x 1N (hanger)

– 4x 0.5N

– 4x 1N

– 4x 2N

– 4x 5N

Base plate

– wxh: 300x250mm

– hole spacing: 280x230mm, D=10mm

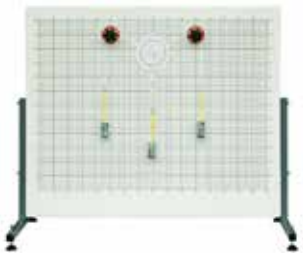
Dimensions and Weight

l x w x h: 300 x 280 x 250 mm

Weight: approx. 15 kg

Link Polygon Apparatus

Descriptions:



For use with the Work Panel, the kit allows several experiments with forces pulling on one or more points at different angles.

Students or teachers fit the magnetic parts of the kit to the Work Panel to study or demonstrate three coplanar concurrent forces (triangle of forces) or more (force polygons).

The kit uses masses, hooks, pulleys and cords to apply forces on a single point (concurrent). Students may also set it to apply forces to two points (non-concurrent). Students measure the forces at equilibrium and compare with theoretical values. The kit introduces 'Bow's Notation' and the drawing method of finding the forces.

The versatility of the kit means that you can set up to five forces at any angles, using its cords, rings, magnetic mounts, magnetic protractors, pulleys, weights and a spring balance.

Friction Slide Apparatus

Descriptions:

The compact bench top unit has a sturdy aluminum base plate, non-slip feet and central vertical pillar.

Pivoting on this base is a ground steel plane which can be locked in any angular position between ±45°, indicated on a semi-circular protractor scale.

Two composite slider trays are supplied. One pair being made out of aluminum and steel, whilst the other is made from nylon and brass. You simply turn over the trays to test one of the other. Each tray in turn is attached to a weight hanger and weights are added until the tray just begins to slide. The slider trays also allow for additional weight to be added changing the experimental scope.

The hanger cord pulls the tray up the sloping steel plane whilst passing over a pulley and bearing. The bearing reducing friction to ensure accurate results.

The experiment may also be used as an exercise in equilibrium of forces, determining the force required to move the tray along the plane giving the coefficient of friction.

The apparatus comes supplied with a comprehensive instruction manual for student and lecturer, weights set and hanger.

Fly Wheel Apparatus

Descriptions:

This apparatus is designed to demonstrate the working principle of fly wheel and its practical significance in industry. Fly wheel is used to store rotational energy when the supply of energy is more than the required, and delivers when requirement of energy is more than the supplied.

1) Self contained.
2) Wall mounting includes a pointer to the periphery of the wheel
3) To demonstrate the Second law of motion and energy storage
4) Running in ball bearings.
5) A load hanger and cord supplied.
6) 250mm x 30mm steel flywheel with engraved line on periphery
7) Instruction manual for student and lecturer provided.
8) Stop watch supplied
9) Set of weights.
10) Dimensions and Weight (excluding set of weights): 215 x 280 x 250 mm ; 19 kg (approx)

Cantilever Beam Apparatus

Product details:

Material	Stainless Steel
Weight set	100 gm to 1 kg
Horizontal arm	75 cm
Vertical arm	20 cm
Display	Analog
Frequency	50 Hz

Consists of a Stainless steel beam of L type shape with horizontal graduated horizontal arm 75cm and vertical arm of 20cm, with a spring balance of 10 kg capacity to make the horizontal leg horizontal under any load. Complete with one sliding slotted set weight set 100gm to 1 kg.

Bending Moment Apparatus

Product Description

The long and short sections of the teak wood beam are connected by hinge. A spring balance with adjusting screw mounted at a fixed distance enables one to calculate the bending moment for any load position. Another special attachment with an adjustable screw is also provided. This along with a spring balance and its adjustable screw is used for determining the shear force at the hinge section.

SPECIFICATIONS

1. Beam – 1 mtr. span with supports.
2. Bending moment measurement arrangement .
3. Shear force measurement arrangement.
4. Spirit level to restore the loaded beam to original position.
5. Weight set with loading hangers.

RANGE OF EXPERIMENTS:

1) Determination of shear force for different loading conditions.
2) Determination of bending moment for different loading conditions.
3) Influence line diagram for bending moment & shear force.
The technical manual accompanies the unit.

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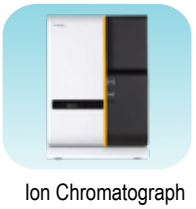

Ion Chromatograph

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