तार Telegram : TECHNOLOGY फैक्स Fax : [0512] 2590914 / 2590260 2597641 2597563

भारतीय प्रौद्योगिकी संस्थान कानपुर
INDIAN INSTITUTE OF TECHNOLOGY KANPUR
भौतिकी विभाग
DEPARTMENT OF PHYSICS

पत्रालय - आई.आई.टी. कानपुर - 208 016 (भारत)
P.O. : I. I. T., Kanpur - 208 016 (INDIA)

Ref. No. :Enq/PHY/AKG/07 Dec.2011

December 7, 2011

From:
Dr. Anjan K. Gupta
Associate Professor
Department of Physics
I.I.T. Kanpur 208016
e-mail: anjankg@iitk.ac.in
Ph. No. 0512-2597549

Sub: Quotations for Modern Physics Experiments

Dear Sir/Madam:

Sealed Quotations with all technical specifications are invited for purchase of following Modern Physics Experiments:

1. **Coulomb's Law Experiment with additional Faraday Ice Pail**:

- To Verify the Inverse Square Law: $F \sim 1/R^2$
- To Verify the Force/Charge Relationship: $F \sim q_1 q_2$
- To Determine Coulomb's Constant: $k = 9.0 \times 10^9\ Nm^2/C^2$

Experiment should Include:

- Coulomb's Law Apparatus
- Kilovolt Power Supply
- Basic Electrometer
- One additional Faraday Ice Pail
- Charge Producers and Proof Plane
- Coulomb's Law Experiment Manual and Relevant Software

a. Coulomb's Law Apparatus:

Coulomb's Law Apparatus should accurately measure charge, force and distance between two conductive spheres. Its symmetrical design minimizes stray and mirror charges and built-in magnetic damping ensures quick, accurate measurements.

TORSION BALANCE: WITH APPROPRIATE TORSION ASSEMBLY, TORSION WIRE AND DEFLECTION MEASUREMENT SYSTEM

CALIBRATED LINEAR TRACK

Sphere	• 38 mm diameter conductive sphere
Range of Movement	• 350 mm in 1 mm increments
Material	• phenolic (to minimize charges)

MISCELLANEOUS EQUIPMENT

Charging Probe	• 17 cm long plus 1.5 m cable • banana plug connector 200 Ω internal resistance
Calibration Masses	• 50 mg (1) and 20 mg (2)
Conductive Sphere on Insulating Thread	• Reduce charge by fixed ratio
Spare Torsion Wire	• 3 m

b. Kilovolt Power Supply:

Kilovolt Power Supply should be ideal for, wherever high potentials are required. The output should be well regulated for repeatable results and current limited for safety. The 6 kV output should be center-tapped, provide simultaneous and symmetrical outputs up to ±3 kV. A built-in meter should read the output potential and 6.3 VAC should be provided for heating the filaments of electron tubes.

Current	• 0.1 mA at 6 kV differential (3 kV each side) • 1.8 mA at 4 kV differential (2 kV each side)
Ripple	• less than 1%
Line Regulation	• less than 1% output change for 10% input change
Meter Scale	• 0-6.5 kV
Power Source	• 115/220 VAC, 50/60 Hz

c. Basic Electrometer

The Basic Electrometer should a quantitative electroscope, measuring the polarity and magnitude of charged objects.

With almost infinite input resistance (10^{14} ohm), the Electrometer is a high impedance voltmeter, draining almost no charge from the object it is measuring.

Voltage input ranges	• 3, 10, 30, 100 volts full scale
Input resistance	• approximately 10^{14} ohms
Input capacitance	• approximately 27 pF
Accuracy	• Analog Meter: ±3%
Signal output	• Fixed at -100 to +100 volt range
Batteries	• 4 "AA" alkaline batteries recommended
Battery life	• approximately 75 hours

d. Faraday Ice Pail

Faraday Ice Pail could use the Electrometer to measure charge as well as potential. Touch the Proof Plane to the point of interest on the charged body, then place the Proof Plane inside the ice pail. The Electrometer reading should be directly proportional to the charge on the Proof Plane.

Faraday Ice Pail should be 10 cm in diameter and 15 cm deep. Constructed of wire mesh, should have easy visibility to what occurs inside. The outside shield should have a diameter of 15 cm.

e. Charge Producers and Proof Plane

The Charge Producers should create equal positive and negative charges, when rubbed together. The Proof Plane samples the charge density from a charged object. The charge could then be measured using the Electrometer and Faraday Ice Pail.

The Charge Producers and Proof Plane also should feature a conducting tip at the bottom of each handle.

2. **Charge, Equipotential and Field Mapper with Electroscope & Classic Electrostatics Materials Kit:**

a. Charge, Equipotential and Field Mapper:

Draw any set of two-dimensional conductors with the conductive ink. Investigate the electric field and the equipotential field lines between and around the conductive paper to any shape. Charge it and investigate the distribution of charge on its surface.

Similar to the Field Mapper Kit, except it also includes electrometer probes, a "point charge" holder and larger sheets of conductive paper for investigating charge distributions on conductive surfaces.

Include:

- Conductive paper for mapping charge distributions; 30 x 45 cm (50 sheets)
- Conductive paper with cm grid for mapping equipotentials and field gradients; 23 x 30 cm (100 sheets)
- Pushpins (10), connecting wire (1) and electrometer probes (2)
- Conductive ink pen and a circular template for drawing conductors
- "Point charge" holder
- Plastic tray with corkboard top; 32 x 48 cm
- Manual with 13 experiments

b. Electroscope:

When the Electroscope is charged, the conductive rod rotates to indicate charge magnitude. The shield ring is 15 cm in diameter and can be grounded with banana plug connectors (not included).

Includes:

Charge Sampler: For transferring charge to the Electroscope

Capacitor Plates (5.6 cm dia.): For testing charges without depositing them on the Electroscope

c. Classic Electrostatics Materials Kit:

Should Provide the classic introduction to electrostatics, kit should allow us to rub any of the 3 rods with rubbing cloths to produce a positive or negative charge. Place the rods on the insulated pivot stands to investigate electrostatic forces.

Includes:

Three rods (acrylic, glass, PVC)

Two insulated pivot stands

Three rubbing cloths (wool, silk, fur)

3. Magnaprobe with 2-D & 3-D Magnetic Field Demonstrator:

a. Magnaprobe:

The Magnaprobe should demonstrate the 3-D nature of magnetic fields. The probe features a gimbal-mounted Alnico magnet which should free to move in the x, y and z dimensions. As the probe is brought near a magnetic field, the alnico magnet aligns itself with the field. Use it to investigate the magnetic field around various geometries of magnets or the magnetic fields around common electrical devices. Suggested activities are included with each probe. Magnaprobe should be 12 cm long.

b. 2-D & 3-D Magnetic Field Demonstrator:

It should consists of 4 plastic plates, each containing 98 small iron bars, a bar magnet and 4 cardboard disks. Place a magnet above or below this demonstrator. Magnetic field lines are clearly revealed as the iron bars align with the field. Lay the plates together to form a large plate, or stand them on edge to map out a 3-D field. Can be viewed directly or used with an overhead projector.

4. Ring Launcher:

An aluminum ring is propelled straight up a maximum distance of 2 meters. The changing magnetic field from the AC powered coil causes a changing magnetic flux through the aluminum ring. The induced EMF in the ring sets up a current which produces a magnetic field. The induced magnetic field opposes the field of the coil, pushing the ring up.

Ring Launcher has been optimized to launch the ring higher and to maximize safety by enclosing all wiring inside the case. A thermal shut-off switch protects the coil by preventing overheating when the momentary launch switch is held down for a prolonged time. A red light indicates when the thermal switch is activated, and further launches are prohibited until the device cools.

Voltage	220 VAC
Fuse	8 A max. temp. 60 °C
Aluminum Ring	2.2 cm inside diameter
Launcher Dimensions	12 x 18 x 30 cm

5. Ring Launcher Accessories:

The accessory set for Ring Launcher should include a coil with a bulb that lights by induction when the coil is placed over the launcher core. Also include three additional rings: one split aluminum ring that will not launch, one copper ring to show the effect of changing materials and one shorter aluminum ring with higher resistance to show that it will not go as high because of decreased induced current.

Terms and Conditions:

All technical features should be mentioned clearly, Mentioned all spares list.
All charges should be mentioned clearly. Warranty, training installation clause should be mentioned. If proprietary item then please enclosed the certificate in this regard. If dealer, then enclosed the authorization from manufacturer with the quotation. Without proper information and literature quotation will not entertain.
The quotations should reach to above mentioned address on or before December 15, 2011.
Sincerely,

Anjan K. Gupta