Republika ng Pilipinas
(Republic of the Philippines)
MINISTRI NG EDUKASYON AT KULTURA
(MINISTRY OF EDUCATION AND CULTURE)
Maynila

June 26, 1979

MEC O R D E R
No. 36, s. 1979

GUIDELINES FOR OPENING OF ENGINEERING SCHOOL OR COURSE

To: Bureau Directors
Regional Directors
Schools Superintendents
Heads of Private Schools, Colleges and Universities

1. For the information and guidance of all concerned, inclosed are the guidelines and minimum standards for the opening of new engineering schools or courses prepared by the Technical Panel for Engineering Education.

2. Strict compliance with these guidelines and standards is required. No go-signal to consider an application for Engineering or permit to operate the said course shall be granted unless these guidelines and standards have been satisfactorily complied with.

3. This Order shall take effect immediately.

(SGD.) JUAN L. MANUEL
Minister of Education and Culture

Incl.:
As stated

References:
Department Orders: Nos. 43, s. 1976 and
35, s. 1977

Allotment: 1-4—(D.O. 1-76)

To be indicated in the Perpetual Index under the following subjects:

Course of Study, COLLEGIATE — CURRICULUM

RULES & REGULATIONS UNIVERSITIES & COLLEGES

(Inclosure to MEC Order No. 36, s. 1979)

GUIDELINES AND MINIMUM STANDARDS FOR THE OPENING OF SCHOOLS AND/OR COURSES IN ENGINEERING

I. Letter of Request must be submitted to the regional office concerned on or before September 30 immediately preceding the school year when such school/course will start to operate. The request should be accompanied with a notarized feasibility study comprehensively covering the following factors supported with sufficient evidence:

A. Purpose and objectives of the proposed school/course for engineering;

B. Need or demand for the establishment of the school or operation of the course in the locality. If the course is already being offered in the same town or city, there must be evidence of the following factors:

1. Engineering enrolment in the existing school;

2. Total student enrolment of the community; and

3. Facilities, standards and supportive provisions for effective instruction and quality education.

C. Availability and adequacy of school site and building including documents of ownership thereof, location plan, development plans, pictures and architect's plan of building if the same is still to be constructed.

D. Itemized cost of the Project covering the entire course in terms of site, site development, school buildings and quarters, classroom equipment and facilities, library, laboratory, monthly or annual salaries of faculty and other personnel, other essential equipment and maintenance.

E. Proposed faculty line-up and administrative and supervisory staff together with their Bio-Data, individual Transcript of Records and Letter of Intent.

F. Financial capacity of applicant including his resources to provide the requirements for the entire course and support its operation from year to year without depending solely on student fees.

II. The above request, together with the supporting papers, as evaluated by the Regional Director shall be submitted to the Ministry of Education and Culture for action and/or decision.

## FACILITIES AND STANDARDS

1. Purpose and Objectives

The purpose and objectives of an institution in receiving students and offering them instruction must be in agreement with their actual educational practices. These should be determined in the light of the needs of the clientele which it intends to serve and the community in which it exists. The institution should include a well-integrated program for the development of moral character and personal discipline in its students. It should also include an adequate program completion of the whole course in Engineering and to practice and train students as responsible citizens of the country.

2. School Site

The site should be located in a wholesome environment. Its size should be adequate to meet the needs of the present school population and its future expansion. The areas of school sites shall, as a general rule, be as follows:

One-half hectare for a school with an enrolment of 500 or less students;

One hectare for a school with an enrolment of 501 to 1000 students;

Two hectares for a school with an enrolment of 1001 to 2000 students;

Three hectares for a school with an enrolment of 2001 to 3000 students;

As a general rule, the same ratio should be maintained for enrolment in excess of 3000.

3. Building Requirement

The school building should satisfy appropriate zoning and building regulations and should conform with the National Building Code and Fire Code.

4. Laboratory and Technical Equipment

The schools should have laboratory facilities, materials and equipment that are adequate not only for instructional and exporimental work but also for researches. Besides being adequate, laboratory materials and equipment must measure up to modern scientific standards, and the laboratory itself shall include provisions for safety in cases of accidents, fires, etc. (Please refer to Annex A for minimum equipment requirements).

5. Library

Every school or college of Engineering shall have a library with materials and facilities which, in terms of quality and quantity, are reasonably adequate for engineering work. The library should be easily accessible and should have adequate quarters to accommodate its collection, staff and clientele. It should contain an acquisition of up-to-date reference books, journals and other reading materials, in support of the course offerings and in proportion to the enrolment of the school or college. For seating capacity, ten percent (10%) of the enrolment and academic staff combined should be considered as a minimum requirement.

6. Administration

Must have a qualified Dean who shall serve on a full-time basis. As a general rule he should be a graduate of any engineering discipline, with an appropriate post graduate course from a duly accredited school with at least five (5) years of teaching experience and three (3) years experience in the administration of a school or college.

7. Faculty

As a general rule, the member of the faculty assigned to teaching professional engineering should be graduate of appropriate Master's course from duly accredited institutions; other subjects shall be taught by faculty members along their respective areas of specialization.

8. Curriculum

Engineering Curricular Requirement as prescribed by the Ministry of Education and Culture.

III. Upon approval of the request for go-signal to prepare the facilities and other requirements for the course or courses, the applicant-school files its application to operate those courses. Application forms are provided by the MEC. The applicant-school pays an application and inspection fee of ₱52.50. The receipt for such payment and a proposed schedule of fees prepared on the proper format (Form II in triplicate) should be attached to the application form. The applicant should also prepare its facilities for inspection.

SOIL MECHANICS LABORATORY
(LABORATORY CLASS OF 25 STUDENTS)

| EQUIPMENT | QUANTITY |
|---|---|
| **FIRST PRIORITY LIST** | |
| 1. Soil Sampler | 1 |
| 2. Balance (Sensitive to 0.1 GM.) | 2 |
| 3. Oven with temperature Control | 1 |
| 4. Standard Sieves | 2 sets |
| 5. Soil Lathe | 1 |
| 6. Pycnometer Jar | 3 |
| 7. Thermometer (Accurate 1 $^{o}$F) | 3 |
| 8. Dessicator | 1 |
| 9. Hydrometer | 3 |
| 10. Mechanical Stirring Apparatus | 1 |
| 11. Liquid Limit Device | 1 |
| 12. Shrinkage Limit Set | 1 |
| 13. Permeameter | 1 |
| 14. Unconfined Compression Test | 1 |
| 15. Cylinder and Tamper | 1 |
| 16. Extension Meter Assembly | 1 |
| 17. Timer or Stop Watch | 1 |
| 18. Graduated Cylinder | 3 |
| **SECOND PRIORITY LIST** | |
| 1. Direct Shear Machine | 1 |
| 2. Vane Shear | 1 |
| a) Proving Ring Assembly | 1 |
| b) Extensometer Assembly | 1 |
| c) Remolding Cylinder and Tamper | 1 |
| 3. Triaxial Testing Apparatus | 1 set |
| 4. Consolidometer | 1 set |
| a) Extensometer Assembly | 1 |
| b) Loading Device | 1 |
| 5. CBR Set | 1 |
| **THIRD PRIORITY LIST** | |
| 1. Wire Saw | 2 |
| 2. Sharp Knife | 2 |
| 3. Meter Box | 4 |
| 4. Extruder | 1 |
| 5. Sampler Splitter | 1 |
| 6. Mortar and Rubber Pestle | 2 sets |
| 7. Water Bath | 1 |
| 8. Spatula | 3 |
| 9. Drying Cans | 3 |
| 10. Evaporating Dish | 3 |

| EQUIPMENT | QUANTITY |
|---|---|
| 11. Guide Plate | 3 |
| 12. Sand Funnel | 1 |
| 13. Soil Pan | 1 |
| 14. Calibration Bucket | 1 |
| 15. Cylindrical Metal Mold | 2 |
| 16. Metal Rammer | 1 |
| 17. Straight Edge | 2 |
| 18. Large Mixing Pan | 1 |

## SURVEYING
## (LABORATORY CLASS OF 25 STUDENTS)

### FIRST PRIORITY LIST

| | |
|---|---|
| 1. Transit Standard | 6 |
| 2. Dumpy Level | 3 |
| 3. Wye Level | 3 |
| 4. Plane Table with Alidade | 3 |
| 5. Sextant | 2 |
| 6. Brunton Compass | 6 |
| 7. Levelling Rods with Extender | 12 |
| 8. Stadia Rods | 6 |
| 9. Steel Tapes, ¼ inch, 25M, & 50M | 12 |
| 10. Hand Levels | 6 |
| 11. Planimeter | 2 |
| 12. Automatic Level | 4 |

### SECOND PRIORITY LIST

| | |
|---|---|
| 1. Theodolite | 1 |
| 2. Precision Level | 1 |
| 3. Clinometers | 6 |
| 4. Current Meter | 1 |
| 5. Stereoscope | 1 |
| 6. Pantograph | 1 |
| 7. Tape Thermometer (surface thermometer) | 6 |
| 8. Spring Balance | 6 |

### THIRD PRIORITY LIST

| | |
|---|---|
| 1. Range Poles | 12 |
| 2. Marking Pins | 60 |
| 3. Plumb Bob | 12 |
| 4. Three-Arm Protractor | 1 |

MATERIALS TESTING LABORATORY
(LABORATORY CLASS OF 25 STUDENTS)

| FIRST PRIORITY LIST | QUANTITY |
|---|---|
| **I. ASPHALT TESTING** | |
| 1. Extractor, 1000 G. Capacity | 1 |
| 2. Penetrometer with Accessories | 1 |
| 3. Specific Gravity Bottle | 1 |
| 4. Viscosimeter | 1 |
| 5. Stabilometer | 1 |
| 6. Hubbard Field Set or Triaxial Chamber | 1 |
| **II. CEMENT TESTING** | |
| 1. Fineness Device | 1 |
| 2. Soundness Tester | 1 |
| 3. Le Chatelier Apparatus | 1 |
| 4. Vicat Apparatus | 1 |
| 5. Gilmore Apparatus | 1 |
| 6. Air Content Apparatus | 1 |
| **III. CEMENT MORTAR AND CONCRETE** | |
| 1. Flexural Strength Apparatus | 1 |
| 2. Penetrometer | 1 |
| 3. Bond Test Set | 1 |
| 4. Slump Cone Set | 1 |
| **IV. FINE AND COARSE AGGREGATES** | |
| 1. Specific Gravity Set (Coarse) | 1 |
| 2. Sieves (#10, 20, 30, 40, 50, 60, 80, 100, 200, 1½", 1", ¾", ½", 3/8") | 2 sets |
| 3. Aggregate Shaker | 1 |
| **V. CONCRETE, METALS, WOOD** | |
| 1. Universal Testing Machine with Accesories for Compression, Tensils, Bending, Shear, Flexural (60,000 lbs. capacity) | 1 |
| 2. Hardness Tester (e.g. Brinnel) | 1 |

VI. OTHER EQUIPMENT

| | |
|---|---|
| 1. Vernier Caliper | 2 |
| 2. Moisture Indicator | 1 |
| 3. Analytical Balance with Set of Weights | 2 |
| 4. Platiform Balance with Set of Weights | 2 |
| 5. Micrometer Caliper | 2 |
| 6. Thermometers | 2 |
| 7. Oven | 1 |

SECOND PRIORITY LIST

| | |
|---|---|
| 1. Bath | 2 |
| 2. Molds | |
| a) 2" x 2" Mortar | 6 |
| b) 6" x 6" Cube | 6 |
| c) 6" x 12" Cylinder | 6 |
| 3. Humidity Cabinet | 1 |

# FLUID MECHANICS LABORATORY
## (LABORATORY CLASS OF 25 STUDENTS)

| EQUIPMENT | QUANTITY |
|---|---|
| **FIRST PRIORITY LIST** | |
| 1. Barometers | |
| a. Mercurial | 1 |
| b. Aneroid | 1 |
| 2. Manometers | |
| a. U-Tubes | 5(1 Bank of 12) |
| b. Differential | 5 |
| 3. Bourdon Gages (Six Ranges) up to 100 psi) | 1 set |
| 4. Flowmeter | |
| 5. Pilot Tubes | |
| 6. Venturi Meters | |
| 7. Orifices | Bench Type Flowmeter Calibration Rig |
| 8. Weir | |
| 9. Hook and Point Gauges | |
| 10. Nozzles | |
| 11. Centrifugal Pump | |
| 12. Flow Visualisation Rig | 1 |
| **SECOND PRIORITY LIST** | |
| 1. Pipe Network Made of Pipes of Several Sizes, Qualities or Material with Control System | 1 |
| 2. Modular Flume | 1 |
| **THIRD PRIORITY LIST** | |
| 1. Kaplan Turbine | 1 |
| 2. Francis Turbine | 1 |
| 3. Pelton Turbine | 1 |
| 4. Psychrometer | 1 |
| 5. Hygrometer | 1 |
| 6. Rain Gauges | 2 |
| 7. Evaporation Pan | 1 |
| 8. Water Level Recorder | 1 |
| 9. Sunshine Recorder | 1 |
| 10. Anemometer | 1 |
| 11. Fluid Power System | 1 |

SHOP

| EQUIPMENT | QUANTITY |
|---|---|
| **FIRST PRIORITY LIST** | |
| 1. Disc Sander | 1 |
| 2. Jack Planes | 6 |
| 3. Smoothing Planes | 6 |
| 4. Chisels (Various Sizes) | 6 sets |
| 5. Braces and Bits (Various Sizes) | 6 |
| 6. Hammers | 6 |
| 7. Spoke Shaves | 6 |
| 8. Handsaws | 6 |
| 9. Try-Squares | 6 |
| 10. Bevels | 6 |
| 11. Marking Gauges | 6 |
| 12. Wood Files | 6 |
| 13. Screw Drivers | 6 sets |
| 14. Wrenches | 6 sets |
| 15. Center Punch | 6 |
| 16. Vises | 6 |
| 17. Plumbing Tools | 1 set |
| 18. Electrical Hand Tools | 1 set |
| 19. Grinder | 1 |
| 20. Rules | 6 |
| 21. Clamps | 6 |
| 22. Paint Brushes (Assorted) | 6 |
| 23. Tin Smithing Tools | 1 set |
| 24. Axes | 6 |
| 25. Crowbars | 2 |
| **SECOND PRIORITY LIST** | |
| 1. Wood Lathe | 1 |
| 2. Wood Plan | 1 |
| 3. Band Saw | 1 |
| 4. Drill Press | 1 |
| 5. Jointer | 1 |
| 6. Circular Saw | 1 |
| 7. Welding Equipment | 1 set |

## POWER & INDUSTRIAL LABORATORY EQUIPMENT

NOTE: GOOD ONLY FOR TWENTY FIVE (25) STUDENTS PER LABORATORY SUBJECT

| EQUIPMENT | QUANTITY |
|---|---|
| **A. STEAM LABORATORY (TABLE MODEL)** | |
| 1. Steam Boiler | 1 |
| 2. Steam Turbine | 1 |
| 3. Steam Engine | 1 |
| 4. Special Tools and Service Manuals | |
| **B. INTERNAL COMBUSTION ENGINEERING LABORATORY** | |
| 1. Gasoline engine for physical study, preferably cut-out cross section | |
| a) 2-stroke cycle | 1 |
| b) 4-stroke cycle | 1 |
| 2. Gasoline engine, 4 cycle, 4-stroke cycle for experiment | 1 |
| 3. Diesel engine for physical study, cutout cross section | 1 |
| 4. Diesel-Electric generating set | 1 |
| **C. INDUSTRIAL LABORATORY** | |
| 1. Air Compressor | 1 |
| 2. Refrigerating Equipment | |
| a) Air-conditioning/Refrigeration Trainer | 1 |
| 3. Heating Chamber and Drying Chamber | 1 |
| 4. Evaporator System (Using steam, solar, etc.) | 1 |
| **D. FLUID LABORATORY** | |
| 1. Hydraulic Turbine (Reaction) | 1 |
| 2. Pelton Turbine | 1 |
| 3. Centrifugal Pump (variable speed and impeller) | 1 |
| 4. Other types of pumps | 7 |
| 5. High pressure vessel | 1 |
| 6. Hydraulic pump set | 1 |
| 7. Fans and Blowers | 1 |

## MACHINE SHOP TOOLS AND EQUIPMENT

| EQUIPMENT | QUANTITY |
|---|---|
| 1. Lathe Machine | |
| a) Precision (gear type) | 1 |
| b) Production type | 4 |
| 2. Power Hacksaw | 1 |
| 3. Tool Grinder | 2 |
| 4. Shaper | 1 |
| 5. Radial Drill Press | 1 |
| 6. Universal Milling Machine | 1 |
| 7. Bench Grinder | 2 |
| 8. Hydraulic Press | 1 |
| 9. Vises | 20 |
| 10. Tool Cabinets | |

### FOUNDRY SHOP

| | |
|---|---|
| 1. Balance Laboratory | 1 |
| 2. Electric furnace | 1 |
| 3. Foundry Package | 1 |
| 4. Oxy-acetylene Set | 2 |
| 5. Arc-welder | 2 |
| 6. Di-Acro Metal Fabrication Center | |
| 7. Forge Machine | |
| 8. Spot Welder | 2 |
| 9. Blower | 1 |
| 10. Anvil | 20 |
| 11. Blacksmith Vises | 5 |
| 12. Tool Cabinets | |

### WOOD WORKING SHOP

| | |
|---|---|
| 1. Wood Lathe | 1 |
| 2. Bandsaw (heavy) | 1 |
| 3. Grinder | 3 |
| 4. Shaper | 1 |
| 5. Disc Sander | 1 |
| 6. Drill Press | 2 |
| 7. Jointer/Planer | 1 |
| 8. Circular Saw | 1 |
| 9. Tool Cabinets | |
| 10. Router | |

TOOL & INSTRUMENTATIONS

A. DEVICES FOR MEASURING, CALIBRATING & TESTING

| | |
|---|---|
| 1. Pressure Gages | 5 |
| 2. Thermometers | 10 |
| 3. Pyrometer | 2 |
| 4. Psychrometer | 5 |
| 5. Tachometer/revolution counter | 5 |
| 6. Manometer | 5 |
| 7. Platform Scale | 2 |
| 8. Engine Indicator | 2 |
| 9. Planimeter | 2 |
| 10. Nozzle Injection Tester | 1 |
| 11. Cell Tester | 2 |
| 12. Hydrometer | 3 |
| 13. Pilot tube | 1 |
| 14. Mold Hardness Tester (dry) | 1 |
| 15 Mold Hardness Tester (green) | 1 |
| 16 Permeability Tester | 1 |
| | 1 |

B. TOOLS

| | |
|---|---|
| 1. Machine Shop | One (1) Lot |
| 2. Welding Shop | " |
| 3. Wood-working Shop | " |
| 4. Foundry Shop | " |

PHYSICAL CHEMISTRY
LABORATORY EQUIPMENT

A. Determination of Vapor Densities

| | |
|---|---|
| 1. Gas Density Bulbs (Dumas) | 6 |
| 2. Victor-meyer Apparatus | 4 |

B. Measurement of Properties of Liquids, Density, Vapor Pressure, Viscosity or Surface Tension

| | |
|---|---|
| 1. Pycnometer | 6 |
| 2. Isoteniscope Vapor Pressure Set-up with Vacuum Pump | 1 |
| 3. Viscosimeter (Oswald) | 4 |
| 4. Du Nouy Ring-Pull Apparatus or Bubble Pressure Apparatus | 1 |

| EQUIPMENT | QUANTITY |
|---|---|
| C. Determination of Heats of Reaction and/or Heats of Solution | |
| 1. Calorimeter | 1 |
| 2. Sensitive Mercury Thermometer | 3 |
| 3. Theristor Thermometer with Wheatstone Bridge | 1 |
| 4. Lamp and Scale Galvanometer | 1 |
| 5. Calibrated Ammeter with 1-amp. scale | 1 |
| 6. 6-volt Storage Battery | 1 |
| 7. Stop Watch | 1 |
| 8. Weighing Bottles | box of 6 |
| 9. Switch and Wires | |

CHEMICAL ENGINEERING

PHYSICAL CHEMISTRY
LABORATORY EQUIPMENT

| | |
|---|---|
| D. Colligative Properties of Solutions: Boiling Point Elevation and/or Freezing Depression of Solutions of Non-Volatile Electrolytes | |
| 1. Beckman Thermometer or Sensitive Mercury Thermometer | 2 |
| 2. Bunsen Burner | 4 |
| 3. Iron Stand and Ring | 5 |
| 4. Test-Tube | box of 72 |
| E. Conductance Measurement Conductance of Solutions of Electrolytes and/or Sparingly Soluble Salts | |
| 1. Conductance Cell | 2 |
| 2. Wheatstone Bridge Assembly and Conductance Bridge | 1 |
| 3. Thermostat | 1 |
| 4. 50 and 100 ml. volumetric flask | |

| EQUIPMENT | QUANTITY |
|---|---|
| **F. Measurement of EMF of Cells: Determination of Standard Electrodes Potential: Free Energy and Equilibrium Constants.** | |
| 1. Two Glass-Stopped Bottles | 2 |
| 2. Platinum Electrode | 1 |
| 3. Silver Electrode | 1 |
| 4. Crystallizing Dish | 1 |
| 5. Calomel Cell | 1 |
| 6. Potentiometric Assembly | 1 |
| **G. Kinetics of Reactions: Inversion of Sugar or Other Reactions** | |
| 1. Polarimeter | 1 |
| 2. Mercury Vapor Lamp with Filters or Sodium Vapor Lamps | 1 |
| 3. Thermostat and Circulating Pump | 1 |
| 4. Two Water-Jacketed Polarimeter Tubes | 1 |

CHEMICAL ENGINEERING

| | |
|---|---|
| **A. FLUID FLOW EXPERIMENTS** | |
| 1. Combined Setup for Measurement of Flow and Pressure Drop thru Pipes and Fittings | 1 |
| 2. Water Pumps and Motor (3/4 HP) | 1 |
| **B. HEAT TRANSFER EXPERIMENTS** | |
| 1. Setup for the Determination of Heat Losses and Heat Transfer Coefficients in Bare, Firmed and Lagged Pipes | 1 |
| 2. Temperature Measuring Instruments(2 Thermo couples with Meters or 1 Electronic Surface Temperature Measurement) | 1 |

CHEMICAL ENGINEERING

| EQUIPMENT | QUANTITY |
|---|---|
| C. MASS TRANSFER EXPERIMENT | |
| 1. Setup for the Determination of Mass Transfer Coefficients (Homogenizing Tank and Mixer) | 1 |
| 2. Dissolved Oxygen Meter | 1 |
| 3. Variable Speed Motor (3/4 HP, 3-Phase Synchronous up to 1,000 RPM) | 1 |
| D. COMBINED TRANSFER OPERATIONS EXPERIMENTS | |
| 1. Single-Effect Evaporating System | |
| a. Single-Effect Evaporating System (Vertical type, instrumented, with condensers) | 1 |
| b. Motor and Pump (1/2 HP) | 1 |
| c. Vacuum Pump with Motor | 1 |
| 2. Cooling Tower System (50 CFM) complete with Blowers, etc. | 1 |
| 3. Double-Pipe Heat Exchanger System | 1 |
| E. STAGEWISE OPERATION EXPERIMENT | |
| 1. Packed Column Assembly (Glass) | 1 |
| F. SEDIMENTATION AND FILTRATION EXPERIMENTS | |
| a. Sedimentation setup | 1 |
| b. Single-leaf vacuum filter system with vacuum pump | 1 |
| G. REACTION KINETICS EXPERIMENT | |
| 1. Laboratory Reactor Set ("Quick-Fit", Glass, complete with heating Mantle, Condenser and Stirer) | 1 |
| 2. Motor (1/4 HP) | 1 |

| E Q U I P M E N T | QUANTITTY |
|---|---|
| **GENERAL PURPOSE EQUIPMENT FOR THE CHEMICAL ENGINEERING LABORATORY** | |
| 1. Analytical Balance (Mettler) | 1 |
| 2. Heavy-Duty Weighing Platform Scale (up to 25 kgs.) | 1 |
| 3. Hot-plate (Electric 2-plates) | 1 |
| 4. Air Compressor (10 CFM/OPERATING PROCESS 50 psi) | 1 |
| 5. Boiler (min.-15 BHP) | 1 |
| 6. Assorted Glasswares (Cylinder Breakers, Flasks, Fumes, etc. as Specified) | 1 |
| **PROCESS SUPPLY EQUIPMENT** | |
| 1. Air Compressor (10 CFM/OPERATING PROCESS, 50 psi up to 100 psi) | 1 |
| 2. Boiler for Steam Production (min.-15 BHP) | 1 |
| 3. Vacuum Pump | |
| **ELECTRICAL ENGINEERING (LABORATORY CLASS OF 25 STUDENTS)** | |
| **FIRST PRIORITY EQUIPMENT** | |
| 1. AC Generator/Motor | 2 |
| 2. DC Generator/Motor | 2 |
| 3. Sine/Square Wave Generator | 4 |
| 4. Alternator | 4 |
| 5. Tachometer (RPM Meter) | 4 |
| 6. Precision Multimeter | 4 |
| 7. Vom (Multitester) | 4 |
| 8. VTVM (Multitester) | 4 |
| 9. Instrument Current Transformer | 4 |
| 10. Instrument Voltage Transformer | 4 |
| 11. Multitapped Step-Down Transformer | 4 |
| 12. Variac | 4 |
| 13. AC Voltmeter | 8 |
| 14. DC Voltmeter | 8 |
| 15. AC Ammeter | 8 |
| 16. DC Ammeter | 8 |

| EQUIPMENT | QUANTITY |
|---|---|
| 17. Power Factor Meter | 4 |
| 18. High Resistance Tester (Megger) | 4 |
| 19. Multi-Volt Meter | 6 |
| 20. Milliammeter | 6 |
| 21. Wattmeter Single Phase | 6 |
| 22. Wattmeter Three Phase | 4 |
| 23. Watthour Meter | 4 |
| 24. Impedance Bridge | 4 |
| 25. Wheatstone Bridge | 4 |
| 26. Audio Signal Generator | 6 |
| 27. RF Signal Generator | 6 |
| 28. Sawtooth Generator | 6 |
| 29. Grid Dip Meter | 4 |
| 30. Frequency Meter (up to 10 MC) | 4 |
| 31. Single-Trace Oscilloscope | 4 |
| 32. Dual Trace Oscilloscope | 4 |
| 33. DC Power Supply | 4 |
| 34. Vacuum Tube Tester | 2 |
| 35. Transistor Tester | 2 |

SECOND PRIORITY

| | |
|---|---|
| 1. Demonstration Panel | 1 |
| 2. Field Theostats | 12 |
| 3. Varmeter | 2 |
| 4. Phase Sequence Indicator | 4 |
| 5. Hook-on Voltmeter/Ammeter | 6 |
| 6. Microammeter | 6 |
| 7. Decade Resistance Box | 4 |
| 8. Field Strength Meter | 2 |
| 9. Stroboscope | 2 |
| 10. Audio Analyzer | 2 |
| 11. Trainer Receiver/X' Meter Broadcast | 4 |
| 12. Dynamometer | 2 |
| 13. Rotary Converts | 2 |
| 14. Controllers | 2 |
| 15. Selsyn | 4 |
| 16. Transducers | 6 |
| 17. Relays | 6 |
| 18. Breakers | 6 |
| 19. Insulators | 12 |

| EQUIPMENT | QUANTITY |
|---|---|
| PHYSICS LABORATORY EQUIPMENT | |
| 1. Measurements, Accuracy Precision | |
| a. Micrometer Caliper<br>b. Vernier Caliper<br>c. Meter Stick (1 Dozen) | 1 |
| 2. Force Component and Addition | |
| a. Force Table<br>b. Composition of Force<br>c. Weight Hangers<br>d. Set of Weights | 1 |
| 3. Moments | |
| a. Meter Stick<br>b. Knife Edge<br>c. Stand<br>d. Set of Weights | 1 |
| 4. Rectilinear Motion | |
| a. Track Apparatus<br>b. Metal Balls<br>c. Meter Stick | 1 |
| 5. Newton's Second Law | |
| a. Linear Air Track Apparatus<br>b. Blower<br>c. Fletcher's Trolley<br>d. Rectifier<br>e. Transformer | 1 |
| 6. Centripetal Force | |
| a. Force Apparatus<br>b. Rotator<br>c. Metal Balls<br>d. Meter Stick | 1 |

| EQUIPMENT | QUANTITY |
|---|---|
| 7. Moment of Inertia | |
| a. Inertia Apparatus<br>b. Stop Watch<br>c. Meter Stick<br>d. Set of Weights | 1 |
| 8. Modulus of Elasticity | |
| a. Optical Lever<br>b. Metal Stick<br>c. Telescope<br>d. Scale | 1 |
| 9. SHM of Spring (Hookes Law Apparatus with accessories and components | 1 |
| 10. Thermal Expansion of Metal | |
| a. Linear Expansion Apparatus<br>b. Steam Generator<br>c. Thermometer<br>d. Meter Stick | 1 |
| 11. Mechanical Equivalent of Heat | |
| a. Mechanical Equivalent of Heat Apparatus<br>b. Thermometer<br>c. Stop Watch<br>d. Balance | 1 |
| 12. Specific Heat | |
| a. Calorimeter<br>b. Steam Generator<br>c. Specimen (5 Samples ., Sn., Pb., Cu., etc.) | 1 |
| 13. Latent Heat of Fusion and Vaporization | |
| a. Water Trap<br>b. Steam Generator<br>c. Calorimeter<br>d. Thermometer ($20^0$C to $110^0$C) | 1 |

| EQUIPMENT | QUANTITY |
|---|---|
| PHYSICS LABORATORY EQUIPMENT | |
| 14. PVT Relationship | |
| a. Boyle's Law Apparatus<br>b. Mercury<br>c. Meter Stick | 1 |
| 15. Coulomb's Law | |
| a. Electrostatic<br>b. Electroscope<br>c. Van de Graaff Generator<br>d. Current Balance Kit<br>e. Dosimeter<br>f. Electrometer Adapter<br>g. Energy Transfer Apparatus<br>h. Dosimeter charger | 1 |
| 16. Ohm's Law | |
| a. Rheostat<br>b. Voltmeter (VOM)<br>c. Resistance Box<br>d. Ammeter (DC)<br>e. Battery | 1 |
| 17. Wheatstone Bridge | |
| a. Slide Wire Apparatus Bridge apparatus<br>b. Portable Galvnometer<br>c. Resistance Box<br>d. Battery (15 V) | 1 |
| 18. Joule's Law-Electric Power Work | |
| a. Resistance Coil<br>b. Transformer<br>c. Rectifier<br>d. Thermometer<br>e. A.C. Ammeter<br>f. A.C. Voltmeter | 1 |

| EQUIPMENT | QUANTITY |
|---|---|
| PHYSICS LABORATORY EQUIPMENT | |
| 19. EMF of a cell Terminal Voltage, Internal Resistance | |
| a. Standard Cell<br>b. Rheostat<br>c. Resistance<br>d. Voltmeter (DC)<br>e. Battery (Internal Resistance)<br>f. VOM (Vacuum Tube Ohmmeter) | 1 |
| 20. Resistors In Series and Parallel | |
| a. Resistance Box<br>b. VOM<br>c. Bulb | 1 |
| 21. RLC-Circuit | |
| a. Voltmeter VTVM<br>b. Inductance<br>c. Capacitance<br>d. Generator<br>e. Resistance Box | 1 |
| 22. Index of Refraction | |
| a. Spectrometer<br>b. Light Source<br>c. Hg, He, H, Ar, Ne, Na<br>d. Prism<br>e. Transformer<br>f. Optical disc | 1 |
| 23. Reflection by Plane and Spherical Mirror | |
| a. Concave and Convex Mirror<br>b. Transformer<br>c. Light Source<br>d. Lens (150 mm.)<br>e. Optical Bench | 1 |

| EQUIPMENT | QUANTITY |
|---|---|
| **PHYSICS LABORATORY EQUIPMENT** | |
| 24. Thin Lenses | |
| a. Lens (Focal Length 50, 100, 150, 200mm.)<br>b. Light Source<br>c. Transformer<br>d. Deverging Lens<br>e. Optical Bench | 1 |
| 25. Prism Spectrometer and/or Diffraction Grating Spectrometer | |
| a. Spectrometer<br>b. Prism<br>c. Light Source<br>d. Transformer<br>e. Diffraction Grating | 1 |
| **GENERAL CHEMISTRY** | |
| 1. Beakers | |
| a. 1,000 ml.<br>b. 500 ml.<br>c. 250 ml. | 6 |
| 2. Burettes | |
| a. 100 ml.<br>b. 50 ml. | 2 |
| 3. Erlenmeyer Flasks | |
| a. 1,000 ml.<br>b. 500 ml.<br>c. 250 ml.<br>d. 100 ml.<br>e. 50 ml. | 6 |
| 4. Florence Flasks | |
| a. 1,000 ml.<br>b. 500 ml.<br>c. 250 ml.<br>d. 100 ml.<br>e. 50 ml. | 6 |
| 5. Gradnated Cylinders | |
| a. 1,000 ml.<br>b. 500 ml.<br>c. 250 ml.<br>d. 100 ml.<br>e. 50 ml. | 6 |
| 6. Liebig Condensers | 6 |