CSM-6	Prestressing Jack with Gripping Cones	Measuring loads applied on tendon.	CE-315:Plain & Reinforced Concrete CE-415: Design of Concrete Structures
CSM-7	Crack Detection Microscope	To observe hair cracks in concrete structures.	CE-315:Plain & Reinforced Concrete

2) Concrete Laboratory

Code No.	Item	Experiments/Practice	Course
CCL-1	Flexural Strength Testing Apparatus for Small Beams Specimen	Measuring the bending strength of a test piece of concrete.	CE-315:Plain & Reinforced Concrete
CCL-2	Poisson's Ratio Measuring Apparatus	Measuring Poisson's ratio.	CE-315:Plain & Reinforced Concrete CE-415: Design of Concrete Structures
CCL-3	Aggregate Crushing Test Set	Crushing test of concrete aggregate.	CE-315:Plain & Reinforced Concrete
CCL-4	6" BS Cube Moulds with Tampering Rod & 6"/12" Cylinder Moulds ASTM with Tampering Rod	To mould test pieces for measuring the concrete strength.	CE-315:Plain & Reinforced Concrete CE-415: Design of Concrete Structures
CCL-5	Creep Test Apparatus	Creep test of concrete samples.	CE-315:Plain & Reinforced Concrete

CCL-6	Thermostatic Curing Tank	To cure concrete samples.	CE-315:Plain & Reinforced Concrete CE-415: Design of Concrete Structures
CCL-7	Ultrasonic Concrete Tester complete with 254 kHz Transducers	To detect defects such as hair cracks in the concrete structures.	-ditto-

3) Soil Mechanics and Highways Laboratory

Code No.	Item	Experiments/Practice	Course
CSH-1	Triaxial Compression Test Set	Testing of the triaxial compression of soil.	CE-414: Soil Mechanics & Foundation Engineering
CSH-2	Electric Unconfined Compression Apparatus	Testing of the compression of soil.	-ditto-
CSH-3	Direct Shear Apparatus	Measuring shearing stress of soil.	-ditto-
CSH-4	One Dimensional Consolidation Set	Measuring mechanical properties of soil by consolidating.	CE-414: Soil Mechanics & Foundation Engineering CE-418: Project
CSH-5	CBR Test Set	Measurement of CBR. To use in the test of road, roadbed and pavement construction works.	CE-414: Soil Mechanics & Foundation Engineering CE-417: Transportation Engineering

CSH-6	Proving Rings for Compression Machine	Rings for the calibration of compression test apparatus.	CE-314: Soil Mechanics CE-414: Soil Mechanics & Foundation Engineering
CSH-7	Constant Head Permeameter	Measurement of the permeability of soil at constant head.	-ditto-
CSH-8	Loading Balance	Measurement of moisture contents of soil.	-ditto-
CSH-9	Motorized Liquid Limit Device	Measurement of the liquid limit of soil.	CE-314: Soil Mechanics CE-418: Project
CSH-10	Falling Head Permeameter	Measurement of the permeability of soil at falling head.	CE-314: Soil Mechanics CE-414: Soil Mechanics & Foundation Engineering
CSH-11	Shrinkage Limit Determination Equipment	Investigation of the limit of soil shrinkage by decreasing moisture contents.	CE-314: Soil Mechanics CE-418: Project
CSH-12	Field Soil Density Test Set	Measurement of soil density.	-ditto-
CSH-13	Dial Gauges	Measurement of dimensions.	CE-314: Soil Mechanics CE-414: Soil Mechanics & Foundation Engineering

CSH-14	Plastic Limit Determination Equipment	Measurement of the critical moisture contents in soil when the soil transmits from elastic state to plastic state.	CE-314: Soil Mechanics CE-418: Project

4) Hydraulics and Fluid Mechanics Laboratory

Code No.	Item	Experiments/Practice	Course
CHF-1	Hydraulics Bench	Experiments on hydraulics.	CE-213: Fluid Mechanics-I
CHF-2	Sediment Transport Demonstration Channel	To learn the mechanism of sedimentation in channels and dams.	CE-411: Irrigation Engineering
CHF-3	Fluid Friction Apparatus	Measurement of fluid friction, head loss etc.	CE-313: Fluid Mechanics-II
CHF-4	Laminar Flow Analysis Table	To learn the flow around cylinder and an aerofoil, and the flow through a sudden contraction or enlargement.	CE-313: Fluid Mechanics-II CE-413: Hydraulics and Hydrology

5) Survey Laboratory

Code No.	Item	Experiments/Practice	Course
CSL-1	Theodolite	To use for traversing and topographic surveying.	CE-216: Surveying-I
CSL-2	Electronic Total Station	For precise measurement of distance.	CE-316: Surveying-II

6) Public Health Engineering Laboratory

Code No.	Item	Experiments/Practice	Course
CPH-1	Cooled Incubator for BOD	For the culture of bacteria to measure BOD.	CE-418: Project
CPH-2	Top Loading Electronic Balance	To weigh samples.	CE-418: Project

(4) Department of Agricultural Engineering

1) Agricultural Machinery and Farm Power Laboratory

Instruction models necessary for learning basic machine elements of various agricultural machines were selected. The selected models are mainly of various engines, fuel injection systems and power transmission systems

2) Soil and Water Engineering Laboratory

Measuring instruments necessary to learn the basic properties of soil and water were selected. Main items are a water quality testing kit, a salinity measurement instrument, a pressure membrane apparatus, a rain gauge and a ground water flow unit.

Table 3.3.6 lists the items of equipment selected, the purposes of use and the courses in which the equipment is required.

Table 3.3.6 Equipment for Department of Agricultural Engineering and Purposes of Use

1) Agricultural Machinery and Farm Power Laboratory

Code No.	Item	Experiments/Practice	Course
AMF-1	Carburetor Model	Model to learn the functions of machine elements.	AGE-441: Farm Power
AMF-2	Fuel Supply Pump (Diesel) Model	-ditto-	-ditto-
AMF-3	Instruction Model Wankel Engine	-ditto-	-ditto-
AMF-4	Instruction Model Four Stroke Petrol Engine	-ditto-	-ditto-

AMF-5	Lubrication Pump	-ditto-	-ditto-
AMF-6	Diesel In-line Pump with Fly Weight Governor	-ditto-	-ditto-
AMF-7	Wall Model of Diesel Injection System	-ditto-	-ditto-
AMF-8	Double Disc Clutch	-ditto-	-ditto-
AMF-9	Clutch Coupling	-ditto-	-ditto-
AMF-10	Torque Convertor	-ditto-	-ditto-
AMF-11	Hydraulic Clutch	-ditto-	-ditto-
AMF-12	Original Steering Gear with Front Axle	-ditto-	-ditto-
AMF-13	Worm Wheel Steering Gear	-ditto-	-ditto-
AMF-14	Disc Brake	-ditto-	-ditto-
AMF-15	Hydraulic Brake	-ditto-	-ditto-
AMF-16	Diesel Fuel System with Turbo Charger	-ditto-	-ditto-
AMF-17	Petrol Fuel System	-ditto-	-ditto-
AMF-18	Ignition System Model	-ditto-	-ditto-
AMF-19	Cooling System Model	-ditto-	-ditto-
AMF-20	Suspension System Model	-ditto-	-ditto-
AMF-21	Tractor's Electrical System Model	-ditto-	-ditto-

2) Soil and Water Engineering Laboratory

Code No.	Item	Experiments/Practice	Course
ASW-1	Dial Type Soil Moisture Gauge, Tensiometer	To measure soil moisture and pressure.	AGE-241: Soil Physics
ASW-2	Quick Draw Soil Moisture Probe	Probe to measure soil moisture. A part of the above instrument (ASW-1).	-ditto-
ASW-3	Soil Moisture Meter & Resistance Blocks	To measure soil moisture and resistance and to investigate soil properties.	-ditto-
ASW-4	Soil Auger Set	An auger to collect soil samples in different depths.	-ditto-
ASW-5	Sieve Analysis Set	To sift soil samples.	-ditto-
ASW-6	Portable Digital pH Meter	To measure pH of soil samples. This is needed to improve soils.	AGE-442: Ground Water & Wells
ASW-7	Electronic Top Loading Balance	To measure the weight of soil samples.	AGE-141: Basic Agricultural Engineering
ASW-8	Unit Type Constant Head Permeameter	To measure permeability of soil. Necessary for soil improvement.	-ditto-
ASW-9	Falling Head Permeameter (Simplified type)	Simplified type having the same function as the above (ASW-8) instrument.	-ditto-
ASW-10	Soil Testing Kit	Instrument to measure constituents of soil.	AGE-241: Soil Physics

ASW-11	Water Quality Testing Kit	Analyses of insoluble minerals in irrigation water and well water.	AGE-442: Ground Water & Wells
ASW-12	Pressure Membrane Apparatus	To measure moisture retaining in different kinds of soil.	AGE-241: Soil Physics
ASW-13	Portable Dial Gauge Soil Thermometer	To measure temperatures of soil in different depths.	-ditto-
ASW-14	Salinity Bridge Measuring Instrument	To measure salinity of soil.	AGE-443: Drainage Engineering
ASW-15	Conductivity / Temperature Meter	Instrument to measure the conductivity of soil. To investigate soil properties.	AGE-241: Soil Physics
ASW-16	Multi-Purpose Water Analysis Meter	Instrument to measure water properties.	AGE-442: Ground Water & Wells
ASW-17	Water Level Recorder	Instrument to measure and record the variations of water level in the soil and wells.	-ditto-
ASW-18	Motorized Liquid Limit Device	Device to measure the critical moisture content in the soil which causes the soil to transit from plastic state to liquid state.	AGE-241: Soil Physics
ASW-19	Chart Recording Rain Gauge	Instrument for measuring and graphing the quantity of precipitation.	AGE-443: Drainage Engineering

ASW-20	Digital Thermo/Anemometer	Instrument for measuring and indicating the force and speed of the wind as well as the temperature.	AGE-141: Basic Agricultural Engineering
ASW-21	Irrigation Displays	Displays to learn various irrigation systems.	AGE-242: Principles & Practices of Water Management
ASW-22	Ground Water Flow Unit	Instrument for measuring the flow of ground water.	AGE-442: Ground Water & Wells

(5) Department of Mining Engineering

As mentioned in Section 3.2.3 "Study of the Equipment Requested", most laboratories of this Department are poorly equipped. The selected equipment is all necessary for basic experiments, practice and demonstrations.

1) Mineral Processing Laboratory

X-ray fluorescence analysis equipment was selected for the analysis of elements of minerals.

The floatation cell is for replacemcnt of the existing one. The automatic pointer scales are also for replacement of the existing ones. The water distillation apparatus is for producing distilled water which is used for preparing floatation reagents. The thermostatic water bath is necessary for keeping the agents at a constant temperature. The pH meter is for measuring pH of the floatation water.

The wet sieve analysis equipment and the two sets of sieves(ASTM & BS) are for replacement of the existing ones. The ultrasonic bath is for cleaning sieves.

Beside these, the following equipment is included; a muffle electric furnace for measuring the ash content of coal, a roll crusher for crushing ores, a high speed blender for blending concentrates and an electronic balance for weighing mineral samples.

2) Rock Mechanics Laboratory

A direct shear test apparatus was selected for measuring the shearing stress in rocks and a strain gauge meter for measuring the strain of bedrock etc.

The core drilling machine, core barrels and rock sample grinder are necessary for producing samples. The Schmidt hammer and the dial vernier caliper are basic tools for mining practice. Spare lamps for the existing

polariscope (white source lamps and mercury lamps) are not available in Pakistan. Therefore, these are included in the request.

3) Mine Surveying Laboratory

A mining suspension theodolite and a laser control theodolite were selected for mining surveying practice.

Some basic measuring instruments and tools for surveying practice were selected such as automatic routine levels, an altimeter, a distance meter, binoculars, stainless steel tapes etc.

4) Drilling Technology Laboratory

A wire line core barrel and diamond bits were selected for demonstration of the structure of drilling machine.

5) Mine Safety Laboratory

Instruments necessary for mine safety and measuring the environment of mine were selected. A multigas detector and a portable equipment for CO, CO_2 detection were selected for measuring gas concentrations in mines, and a portable interferometer for detecting and measuring CH_4 and CO_2.

The miner's safety lamps are for learning lighting in the underground mine.

The portable aneroid barometer and the wet & dry bulb hygrometer are for measuring the conditions of the atmosphere.

6) Mine Ventilation Laboratory

A wind tunnel and a pipe friction/fluid friction apparatus were selected for basic experiments to learn the mine ventilation.

A self contained breathing apparatus, a luxmeter and a Geiger counter

were selected for equipment related to mine safety.

7) Geology Laboratory

The mountain models are for learning the process of mountain formation and faults. The crystal and atomic structure models are for learning crystal structures and atomic structures of minerals.

Beside these, a geological hammer, a geological thin section preparation apparatus and a polarizing microscope were selected for observing samples of minerals.

Table 3.3.7 lists the items of equipment selected, the purposes of use and the courses in which the equipment is required.

Table 3.3.7 Equipment for Department of Mining Engineering and Purposes of Use

1) Mineral Processing Laboratory

Code No.	Item	Experiments/Practice	Course
NMP-1	Water Distillation Apparatus	To produce distilled water necessary for the preparation of chemical agents.	MINE-354: Mineral Processing-I MINE-453: Mineral Processing-II
NMP-2	Wet Sieve Analysis Equipment	For sifting samples.	MINE-354: Mineral Processing-I
NMP-3	Two Sets of Sieves(ASTM and BS)	For classification of crushed particles of minerals.	MINE-354: Mineral Processing-I

NMP-4	X-ray Fluorescence Analysis Equipment	To measure chemical components of concentrate.	MINE-354: Mineral Processing-I MINE-453: Mineral Processing-II
NMP-5	Floatation Cell	To separate rocks and minerals using floatation reagents.	MINE-453: Mineral Processing-II
NMP-6	pH Meter with extra Glass Electrodes	To employ for the pH measurement of the water for floatation.	MINE-453: Mineral Processing-II
NMP-7	Automatic Pointer Scale (for 10 kg)	Instrument which automatically weighs ores during the floatation process and samples ores by weight. To prevent errors by a sampler.	MINE-354: Mineral Processing-I
NMP-8	Automatic Pointer Scale (for 40 kg)	-ditto-	-ditto-
NMP-9	Laboratory Furnace	Apparatus to measure ash content in coal. To be used to measure characteristics of coal.	MINE-453: Mineral Processing-II
NMP-10	Balance	For precise measurement of weight of samples.	MINE-354: Mineral Processing-I MINE-453: Mineral Processing-II
NMP-11	High Speed Blender	To keep concentrates in blended state.	MINE-453: Mineral Processing-II

NMP-12	Thermostatic Water Bath	To keep chemical agents to be used in the floatation at a constant temperature.	-ditto-
NMP-13	Ultrasonic Bath	To clean sieves of fine mesh.	-ditto-
NMP-14	Roll Crusher	To crush ores and to find tearing angles.	MINE-354: Mineral Processing-I

2) Rock Mechanics Laboratory

Code No.	Item	Experiments/Practice	Course
NRM-1	Direct Shear Test Apparatus	To measure shearing stress in rock.	MINE-451: Rock Mechanics Design in Mining
NRM-2	Strain Gauge Meter	To investigate the stress produced in underground bedrock.	-ditto-
NRM-3	White Source Lamp	Spare for the existing lamp.	-ditto-
NRM-4	Mercury Lamp	Spare for the existing lamp.	-ditto-
NRM-5	Rock Sample Grinder	To prepare rock samples and to cut rocks.	-ditto-
NRM-6	Core Drilling Machine	To extract core samples from rock.	-ditto-
NRM-7	Core Barrels	Instrument attached at the top of a core drilling machine.	-ditto-

NRM-8	Schmidt Hammer	To investigate the internal state of rock or structures by striking.	-ditto-
NRM-9	Dial Vernier Caliper	To measure diameter, length, thickness etc.	-ditto-

3) Mine Surveying Laboratory

Code No.	Item	Experiments/Practice	Course
NSV-1	Automatic Routine Level (30x)	To measure the difference of elevation.	MINE-254: Mine Surveying-I
NSV-2	Automatic Routine Level (26x)	-ditto-	-ditto-
NSV-3	Mining Suspension Theodolite	To measure horizontal and vertical angles in the pit.	MINE-355: Mine Surveying-II
NSV-4	Special Thermometer	To measure the surface temperature.	-ditto-
NSV-5	Stainless Steel Tape	To measure length and distance.	MINE-254: Mine Surveying-I MINE-355: Mine Surveying-II
NSV-6	Distance Meter	To measure the distance of two points which can not be measured by a tape.	-ditto-
NSV-7	Altimeter	To measure altitude.	-ditto-
NSV-8	Laser Control Theodolite	To be used to measure horizontal and vertical angles with a laser and to find the distance.	MINE-355: Mine Surveying-II

NSV-9	Binocular	To be used to see the object which can not be seen with naked eyes.	MINE-254: Mine Surveying-I MINE-355: Mine Surveying-II

4) Drilling Technology Laboratory

Code No.	Item	Experiments/Practice	Course
NDT-1	Wire Line Core Barrel	To demonstrate the structure of a wire line core barrel.	MINE-452: Drilling Technology
NDT-2	Marsh Funnel	To measure the concentration and specific gravity of the drilling mud which is used for preventing the collapse of hole sides during the drilling process.	-ditto-
NDT-3	Diamond Bits	To demonstrate various types of diamond bits.	-ditto-

5) Mine Safety Laboratory

Code No.	Item	Experiments/Practice	Course
NMS-1	Portable Equipment for CO, CO_2 Detection	To measure the concentration of CO and CO_2.	MINE-455: Mining Laws & Safety
NMS-2	Portable Interferometer	To detect CH_4,CO_2.	-ditto-

NMS-3	Multigas Detector	To detect and measure the concentration of various gases in the pit or in the atmosphere.	-ditto-
NMS-4	Oil Flame Safety Lamp	Lamp safe in CH_4 gas which occurs in the pit or in the atmosphere.	-ditto-
NMS-5	Wet & Dry Bulb Hygrometer with Carrying Case	To measure humidity in the atmosphere.	-ditto-
NMS-6	Portable Aneroid Barometer	To measure the atmospheric pressure.	-ditto-

6) Mine Ventilation Laboratory

Code No.	Item	Experiments/Practice	Course
NMV-1	Wind Tunnel with Fan	To observe flow and measure the pressure distribution around a flat plate, an aerofoil, cylinder etc.	MINE-457: Mine Environmental Engineering
NMV-2	Self Contained Breathing Apparatus	Survival equipment in the air lack of oxygen.	MINE-457: Mine Environmental Engineering MINE-455: Mining Laws & Safety
NMV-3	Pipe Friction/ Fluid Friction Apparatus	To measure the flow velocity and pressure loss etc. using a manometer, a Pitot tube, nozzles, orifices etc.	MINE-457: Mine Environmental Engineering

NMV-4	Digital Luxmeter	To measure the luminous intensity.	MINE-457: Mine Environmental Engineering MINE-455: Mining Laws & Safety
NMV-5	Geiger Counter	To measure the radiation from ore minerals.	-ditto-

7) Geology Laboratory

Code No.	Item	Experiments/Practice	Course
NGL-1	Polarizing Microscope	To determine rock-forming minerals by observing thin sections of rock and mineral using polarized light.	MINE-251: Mineralogy & Petrology
NGL-2	Crystal and Atomic Structure Model Set of Six Models	To learn crystal chemistry.	-ditto-
NGL-3	Mountain Models	To learn the process of mountain formation and faults.	MINE-152: Physical Geology
NGL-4	Geological Thin Section Preparation Apparatus	To prepare thin samples.	MINE-251: Mineralogy & Petrology
NGL-5	Geological Hammer	To collect mineral samples.	-ditto-

(6) Department of Basic Sciences

The selected equipment is all necessary for basic experiments and demonstrations. There is no specialized equipment selected. Personal computers are used for learning computer use and programming.

1) Physics Laboratory

The Geiger-Muller counter with GM tube source kit is employed to determine the half value thickness of lead by measuring the incident intensity and the transmitted intensity through an absorbing medium or to learn the radioactive decay laws. It is desired to be a kit which can perform all basic experiments on radioactivities. The microwave transmitter and reflecting plates are for learning the reflection, interference and diffraction of waves using microwaves and further to learn the characteristic features of microwaves. It is employed in basic experiments in physics and electrical engineering. Others are power supplies and measuring instruments to perform the experiments described in Table 3.3.8.

2) General Chemistry Laboratory

All items requested for this laboratory are used in chemistry laboratories for the routine work on chemistry experiments. These are necessities of any chemistry laboratory.

3) Analytical Chemistry Laboratory

At present the laboratory has no analytical instrument for qualitative and quantitative analyses. The requested are ordinary instruments for spectrochemical analysis (spectrophotometer), volumetric analysis (potentiometric titration apparatus), electrochemical experiments, gas analysis and microchemical analysis (polarograph). All are necessary to learn basic techniques of chemical analysis. The basic knowledge of chemical analysis is needed in electrical engineering, civil engineering, mechanical engineering, mining engineering and agricultural engineering.

4) Special Laboratory

The equipment requested for this laboratory is the one necessary for the experiments in applied chemistry and chemical engineering required in all Departments of the Faculty of Engineering. The only expensive equipment is the distillation apparatus for fuel.

5) Computer Room

As mentioned in Section 3.2.3 "Study of the Equipment Requested", the personal computers which the students can use for practice are only 14 units and it is not possible that all the students practise the computer. Nowadays the operation of microcomputer and programming are required for all the engineering students. It is necessary for all the students to be able to use the computer at least for hours required to learn the basis of computer use. In this viewpoint, 30 personal computers and 15 printers have been included in the request. As mentioned before, the purpose is to learn computer use and programming.

The equipment for physics experiments is placed in the Physics laboratory. The equipment for general chemistry, analytical chemistry and special laboratory (chemical engineering and applied chemistry) is accommodated in the chemistry laboratory. The personal computers and printers are placed in the computer room. All rooms are spacious enough to accommodate these instruments.

Table 3.3.8 lists the items of equipment selected, the purposes of use and the courses in which the equipment is required.

Table 3.3.8 Equipment for Department of Basic Sciences and Purposes of Use

1) Physics Laboratory

Code No.	Item	Experiments/Practice	Course
BPL-1	Geiger-Muller Counter with GM Tube Source Kit	Radioactive decay laws, Measurement of half value thickness etc.	BSI-103: Physics
BPL-2	Microwave Transmitter & Reflecting Plates	Demonstration of the reflection, interference and diffraction of waves.	-ditto-
BPL-3	DC Power Supply	DC power supply for the demonstration of photoelectric effect, thermal conductivity etc.	-ditto-
BPL-4	H.T. Power Supply 5 kV	High voltage power supply for discharge tubes.	-ditto-
BPL-5	Electrometer	Current-voltage characteristics in dielectrics.	-ditto-
BPL-6	Auto Variable Transformer	To use for measurement of mechanical equivalent of heat by friction cone apparatus.	-ditto-

2) General Chemistry Laboratory — All the items are used in chemistry laboratories for the routine work on qualitative and quantitative analysis.

Code No.	Item	Experiments/Practice	Course
BGC-1	Laboratory Centrifuge	Separation of two liquid phases, of liquid phase and solid phase.	BSI-104: Applied Chemistry, and Courses to conduct chemistry experiments in other Departments.
BGC-2	Magnetic Stirrer	Stirring of liquid.	-ditto-
BGC-3	Flask Shaker	To homogenize liquid shaking flasks or test tubes etc.	-ditto-
BGC-4	Drying Oven		-ditto-
BGC-5	Thermostat		-ditto-
BGC-6	Hot Plate		-ditto-
BGC-7	Water Bath		-ditto-
BGC-8	Heating Mantle		-ditto-
BGC-9	Chamber Furnace		-ditto-
BGC-10	Vacuum Pump		-ditto-
BGC-11	Rotary Vacuum Evaporator		-ditto-

3) Analytical Chemistry Laboratory

Code No.	Item	Experiments/Practice	Course
BAC-1	Atomic Absorption Spectrophotometer	For quantitative analyses of different elements, e.g. the analysis of ores and minerals, steel and other metallurgical products and water quality criteria for mining, mechanical and civil engineering(public health engineering) and also in connection with the "project" work of the students of all the disciplines.	BSI-104: Applied Chemistry, and Courses to conduct quantitative analysis of elements in other Departments
BAC-2	An Arrangement for Potentiometric Titrations	For carrying out acid-base potentiometric titrations to demonstrate titration curves (voltage vs pH), Redox titrations etc. to measure ionization constants of acids and bases and the stability constants of the formation of different chemical species.	BSI-104: Applied Chemistry
BAC-3	Digital Voltmeter to measure pH	To measure pH.	-ditto-
BAC-4	Teflon Beakers with lids and stirrers		BSI-104: Applied Chemistry and any other chemistry experiments
BAC-5	Platinum Crucibles		-ditto-

BAC-6	Electrolysis Apparatus	For experimental work in electro-chemistry, and to carry out the quantitative analysis of metals by electrodeposition with a special purpose of winning the metals by electrolysis.	BSI-104: Applied Chemistry, and Courses to conduct electro-chemical experiments in other Departments
BAC-7	UV Spectrophotometer	For quantitative analysis of trace elements.	BSI-104: Applied Chemistry, and Courses to conduct quantitative analysis of trace elements in other Departments
BAC-8	Polarograph	For quantitative analysis of trace elements.	-ditto-
BAC-9	Gas Analysis Apparatus	Gas analysis.	BSI-104: Applied Chemistry, and Courses to conduct gas analysis in other Departments
BAC-10	Conductivity Meter	Measurement of purity of water.	BSI-104: Applied Chemistry, and Courses to conduct measurement of purity of water in other Departments

4) Special Laboratory

Code No.	Item	Experiments/Practice	Course
BSL-1	Distillation Apparatus for Fuel	Demonstration of petroleum distillation in applied chemistry for the Mechanical Engineering and Mining Engineering Departments.	The laboratory will cater for the requirements of all other Departments
BSL-2	Tar Viscometer	Measurement of tar viscosity.	-ditto-
BSL-3	Carbon Residue Tester	Measurement of carbon residue which is produced after evaporation or pyrolysis of relatively nonvolatile petroleum products such as fuel oils and lubricating oils.	-ditto-
BSL-4	Abbe Refractometer	Measurement of refraction index of materials.	-ditto-
BSL-5	Polarimeter	Measurement of optical rotatory power of optically active substances.	-ditto-
BSL-6	Pressure Gauge (Bourdon type)	Measurement of pressure.	-ditto-

5) Computer Room

Code No.	Item	Experiments/Practice	Course
BCC-1	Personal Computers	To learn computer use and programming	BSI-106: Computer Programming
BCC-2	Printers	-ditto-	-ditto-

(7) Workshop

A universal milling machine and a numerically controlled lathe were selected. The former is selected because the existing one has lost the accuracy and the latter is indispensable for the modern machine tool education.

Table 3.3.9 lists the items of equipment selected, the purposes of use and the courses in which the equipment is required.

Table 3.3.9 Equipment for Workshop and Purposes of Use

Code No.	Item	Experiments/Practice	Course
UWL-1	Universal Milling Machine	Machine tool which produces flat or formed surfaces in a cutting process and does hole machining, cutting of gears etc.	ME-323: Production Engineering-I ME-426: Production Engineering-II ME-428: Project
UWL-2	Numerically Controlled Lathe	Lathe which is program controlled numerically.	-ditto-

3.3.4 Operation and Maintenance Plan

(1) Operation Costs and Sources of Funds

The expenditures of the University are:

1) Personnel Expenses.
2) Utility Expenses (electricity, gas etc.).
3) Equipment and Materials.
4) Maintenance Fees.
5) Annual Maintenance & Repair of University Buildings, Residences & Hostels.
6) Consumable Expenses.
7) Other Expenses.

The total expenditures in 1991-92 is about 50 million Rupees (ref. Table 2.4.10 "Annual Budget of N-W.F.P. University of Engineering and Technology, Peshawar"). The personnel expenses are about 30 million Rupees and other expenses including maintenance fees are about 20 million Rupees. The maintenance fees are about 0.3 million Rupees per year and the consumable expenses are about 0.3 million Rupees, both expenses adding up to only 0.6-0.7 million Rupees. They are only about 3.5 % of the total expenses excluding the personnel expenses. The present budget is enough to cover the maintenance fees and consumable expenses.

The incomes of the University are:

1) Government Grant-in-Aid (from the Ministry of Education through UGC).
2) the University own income (contract researches for public organizations etc.).

The total income in 1991-92 is about 50 million Rupees. The Government Grant-in-Aid is about 47 million Rupees (about 94 % of the income) and the own income is about 3 million Rupees (about 6% of the income). The Government Grant-in-Aid will increase substantially after 1992-93 on the assumption that

this project will be realized. The projection of the Government Grant-in-Aid after 1992-93 is given in Table 3.2.1. The Grant-in-Aid will increase every year by about 14 % of the previous year's amount (that is an annual increase of about 7 million Rupees on the average) and will reach about 70 million Rupees in 1994-95. This is about 1.5 times that of the 1991-92 (about 47 million Rupees) and an increase of about 23 million Rupees. This amount will be enough to cover the increment (estimated about 4 million Rupees) of maintenance costs, consumable costs and utility expenses which will be necessary to maintain and operate the equipment to be installed through this project as well as the increment of personnel expenses with the expansion of teaching staff. No financial problem will come up with the execution of the project.

(2) Maintenance Plan and Staff

As mentioned in Section 3.3.1 "Executing Agency and Operational Structure", the Director Finance is responsible for the assets and keeps a register of assets. The laboratory technical staffs are in charge of the daily operation and maintenance of experimental equipment assisted by laboratory/shop attendants. Placement of these staff members is shown in Table 2.4.3 "Number of Teachers & Staff in Each Discipline". The technical staff amounts to 138 and laboratory/shop attendants 88, the total staff of laboratories being 226. The technical staff number per laboratory is 6 on the average and is sufficient to maintain equipment, to conduct experiments, and to supervise and instruct students. Owing to the careful operation and maintenance by these technical staff members, the existing old instruments are still working in good condition. This reflects high quality of the technical staff. However, in some cases it may be necessary to train some of the technical staff and teaching staff when new equipment is introduced by this project because some kinds of recent engineering educational equipment manufactured in industrialized countries are sophisticated and require some training in their operation and maintenance.

The University has a workshop equipped with lathes, milling machines and other machine tools. The workshop makes parts of experimental equipment and does repair jobs. The Scientific Instrumentation Center of the University has an electronics workshop for repairing, testing and calibration of electronic instruments, a mechanics/optics workshop and a glass blowing section. These facilities provide sufficient support to the maintenance of equipment.

3.4 Technical Cooperation

In addition to a Grant Aid for educational equipment, the University expressed a wish to send its teachers to Japan in a technical cooperation programme and train them at Japanese higher education institutions including acquisition of higher academic degrees so that they can acquire advanced techniques and knowledge and upgrade their professional capability. This request has not yet submitted officially since it has not yet been studied enough by the University. However, this project does not presuppose a technical cooperation programme. The present level of technical capability is considered to be high enough for teaching. In a Grant Aid project, it is more important to enhance the technical capability of equipment maintenance. The teaching and technical staff need to know the maintenance techniques and mechanism of the instruments provided. In this viewpoint, it may be helpful if engineers of major equipment manufacturers give training in the operation and maintenance to the staff at the University after the installation of equipment.

CHAPTER 4 BASIC DESIGN

Chapter 4 Basic Design

4.1 Design Policy

Criteria in the selection of equipment are as follows.

(1) Educational Equipment for Higher Engineering Education

We select equipment appropriate to higher engineering education in line with the purpose of the project. The project is to be designed to provide educational equipment which is fit into the curricula of the University and helpful for the students to learn the fundamentals and applications of technology and to become practical engineers.

(2) Learning of Principles

One of the criteria in selecting equipment is that it should be helpful to learn underlying principles and fundamentals of technology and not much too automated and not much too sophisticated.

(3) Quantity and Versatility

Quantity of equipment should be enough to enable as many students as possible to conduct the same experiment at the same time. The same equipment may be used in several similar but different subjects in different laboratories. Versatility is required.

(4) Facility of Operation and Maintenance

The maintenance must be facile in Pakistan. Support services such as supply of parts and maintenance services should be available. Such equipment as requires difficult operation techniques should be avoided. The operation costs must be as low as possible.

(5) Consideration for Third Country's Products

As mentioned in 3.2.3 "Study of the Equipment Requested", many pieces of equipment manufactured in European and North American countries, particularly equipment made in U.K. are used in engineering universities in Pakistan for historical reasons. Many teachers and technical staff members of the University studied in U.K., U.S.A. and other European countries and they are familiar with instruments and machines made in these countries. In European and North American countries there are many manufacturers which are specialized in educational equipment in particular and provide carefully prepared manuals. For these reasons a certain number of the requested instruments are presumed to be third country's products. The basic design will examine the possibility of providing third country's products in the selection of equipment when the third country's product is more appropriate to the purpose of this project.

4.2 Study and Examination on Design Criteria

4.2.1 Natural Conditions

The temperatures and relative humidities in the laboratories in which equipment is placed are as follows:

	Max. Temp.	Min. Temp.	Max. Rel. Humid.	Min. Rel. Humid.
Air conditioned room	26°C	21°C	40 %	30 %
Not air conditioned room	35°C	12°C	90 %	20 %

4.2.2 Buildings and Utilities

The places to install equipment are in the laboratories on the ground and first floors of the buildings. The points to be considered in the placement of equipment are:

- Placement of the equipment, the weight of which exceeds the maximum allowable load of the floor.

-Placement of the equipment that needs the foundation on which the equipment is fixed.

- Placement of the equipment which vibrates when operated.

- Placement of the equipment which must be placed in an air conditioned room.

Some laboratories will accommodate some pieces of equipment which are a case or cases mentioned above in point. Some will have to be placed in a laboratory on the ground floor and some in an air-conditioned laboratory. When a laboratory needs remodeling or some works to accommodate equipment, the University shall do the work.

(2) Electricity

Electricity is branched to three transformers from the main transmission line and then distributed to 26 main distribution boards. When the installation of equipment causes shortage of electricity or shortage of outlets of single phase 220 V, the University shall install the necessary facilities. The electric power is supplied at:

3-phase AC	440 V ±10 %
1-phase AC	220 V ±10 %
Frequency	50 Hz ±5 %

(3) Water Supply

Water of deep tube wells is supplied by the existing supply facilities of the University.q

4.3 Basic Plan

4.3.1 Equipment Plan

The equipment selected based on the discussions in Section 3.3.3 "Outline of Equipment" and Section 4.1 "Design Policy" is listed as follows. The numerical values in specifications are just for reference and give only rough ideas.

(1) Department of Electrical Engineering

1) Basic Electronics Laboratory

Code No.	Item	Qty	Specifications
EBL-1	Basic Electronics Trainer	5	Selfcontained equipment including power supply for conducting experiments, transistors, diodes, Zener diodes, FETs, SCRs, semiconductor amplifiers, and other semi-conductor devices. Construction panels.
EBL-2	Operational Amplifier Tutor	2	Selfcontained equipment including power supply for conducting experiments and measurements on operational amplifiers
EBL-3	Transistor Amplifier Tutor	2	Selfcontained equipment including power supply for conducting experiments on different types of amplifiers
EBL-4	Power Supplies Teaching Set	3	Selfcontained equipment including all components for conducting experiments and measurement on various types of power supplies for electronic circuits.

2) Digital Electronics Laboratory

Code No.	Item	Qty	Specifications
EDE-1	Advanced Logic Principles	5	Selfcontained equipment including power supplies for teaching logic principles. To be able to teach combinational and sequential digital circuits and numeric displays

EDE-2	Microprocessor Application Trainer	3	Z-80 , 68000 or Intel 8085 microprocessor application trainer with power supply, application modules & cross assembler. Selfcontained equipment including power supplies for teaching microprocessor operation and applications including modules showing temperature control, motor control, traffic lights and binary input output etc.
EDE-3	Logic Constructor	5	Experimental board containing IC sockets, supplies, logic input switches and logic indicators for assembling logic circuits. Power supply
EDE-4	Analogue Computing Module	5	Equipment for showing solution of differential equations. The equipment should include necessary power supplies, operational amplifiers, resistors, capacitors etc. Modules to solve differential equations.
EDE-5	Analogue and Digital System Trainer	3	Digital system trainer: registers, ALU, memory, counter, data selector, decorder, clock, input switches, display, connectors Analogue system trainer: A-D converter, integrator, comparitor, input potentiometer Power supply

3) Power Electronics Laboratory

Code No.	Item	Qty	Specifications
EPE-1	Power Electronics Fundamentals	5	Selfcontained equipment including power supplies for teaching characteristics and applications of power transistors, diodes, thyristors in power control.

EPE-2	A-D/D-A Convertor Circuit Trainer	1	Selfcontained equipment including power supplies for teaching various types of A-D/D-A converter circuits.
EPE-3	Thyristor and Diode Circuit Teaching Unit	1	Single-phase and three-phase AC to DC converter circuits, single-phase transformers with several separate outputs, several diodes and thyristors, phase shifting transformer etc.
EPE-4	AC Motor Control Equipment	1	Control circuits panel AC motors: 1-phase, 3-phase, induction, synchronous, asynchronous

4) Communication Laboratory

Code No.	Item	Qty	Specifications
ECL-1	Digital Communication System	1	Selfcontained equipment including power supplies for teaching digital communications principles including coding of various types, PCM, error correcting codes. To be able to do following experiments: dealing with noise, error detection and correction, clock regeneration, frame synchronization, amplitude shift keying, suppressed carrier systems, frequency shift keying, phase shift keying, generation and reception of various signals
ECL-2	Microwave Trainer	2	Selfcontained equipment including power supplies for teaching microwaves, waveguides, microwave antennas.
ECL-3	Fibre Optics Kit	1	Selfcontained equipment including the necessary transducers, input/output modules, fibre optic cables necessary for teaching Fibre Optic Communications.

ECL-4	Telephony System Tutor	1	Equipment for demonstrating analogue and digital switching principles. Space division multiplex telephone exchange, several telephone sets using pulse dialing, software on disk (to control SDM), interconnecting leads. Software must be run on IBM compatible personal computers
ECL-5	Color TV Trainer (PAL)	1	Equipment for demonstrating PAL Color TV System including necessary carrier generators, modulator, PAL encoder & decoder.

5) Power System Laboratory

Code No.	Item	Qty	Specifications
EPS-1	Combined AC/DC Machine	4	Experiment desk complete with all electrical machines & metering panel
EPS-2	High Voltage Insulation Testing set	1	AC voltage: 50/60 Hz, up to 100 kV rms DC voltage: up to 100 kV Impulse voltage: up to 100 kV For testing insulating materials and parts with AC,DC and impulse voltages
EPS-3	Capacitance and Dissipation factor bridge	1	Designed for testing electrical apparatus insulation systems in hostile environment, such as transformer stations, high voltage switchyards and production floors. The test frequency is shifted slightly away from the power frequency.
EPS-4	Digital insulation resistance tester	1	To be able to detect and diagnose faulty insulation of electrical equipment such as cables, motors, panelboards, switchgears, meters, relays and control circuits. Measurement of insulation resistance at test voltages of 250, 500 and 1000 V. Use for AC, DC voltage and low resistance.

EPS-5	Cable Fault Finders	1	To be able to locate grounded faults on underground, direct-buried, unshielded power or communication cable. Operate from rechargable Nicad batteries.
EPS-6	Phase Sequence indicator	1	Voltage: 90 to 700 V. three-phase.

(2) Department of Mechanical Engineering

1) Theory of Machines Laboratory

Code No.	Item	Qty	Specifications
MTM-1	FFT Analyzer	1	Two channel analyzer, portable Frequency range: 0-100 kHz Accessories: Piezoelectric type pickup 2 Velocity type pickup 2 Displacement type pickup 2 Charge amplifier 2

2) Metallurgy Laboratory

Code No.	Item	Qty	Specifications
MML-1	Universal Testing Machine with recorder	1	Capacity: 50 tons, Analogue or digital display Ram stroke: 200mm
MML-2	Specimen Mount Press with Accessories	1	Capacity: 4,000 kg Hydraulic type
MML-3	High Speed Cut Off Machine	1	Cut off wheels. Cut off thickness: 0.3mm Automatic feed with recirculating coolant system

3) Fuel Engineering Laboratory

Code No.	Item	Qty	Specifications
MFL-1	Bomb Calorimeter	1	Stirring speed: Outer tank 1,800 rpm Inner tank 800 rpm
MFL-2	Gas Calorimeter (complete set)	1	Measurement range: 2,000 - 11,000 kcal/m^3
MFL-3	Saybolt Viscometer	1	Viscosity range: 0.2-0.8 stokes
MFL-4	Cone Penetration Meter	1	Manual type
MFL-5	Orsat Gas Analyzer	1	Pipette for gas intake, Manifold

4) Automobile Engineering Laboratory

Code No.	Item	Qty	Specifications
MAE-1	Fuel Injection Pump Tester	1	1. Fuel injection nozzle with pressure gauge (0-350 kg/cm²) 2. Fuel injection pump with control rack and rotational speed meter 3. Driving motor, Fuel tank strainer 4. Penetration and atomization of fuel are visible in transparent cylinder
MAE-2	Air/Fuel Measuring Equipment	1	Fuel tanks: 4 lit. x 2 Fuel gauge: float type Air flow meter: float type
MAE-3	Front-Axle Measuring Stand with Wish-Bone Suspension	1	1. Camber, Caster, Kingpin gauge 2. Turning radius measuring equipment 3. Twin gauge
MAE-4	Test Stand for Electric/Electronic Systems	1	To test: 1. alternator 2. generator 3. starter motor and batteries 4. diodes
MAE-5	Trouble Shooting Analyzer Kit (Electronic Engine Tester)	1	A kit of electronic tools to test engines
MAE-6	Turbo Super Charger for Diesel Engine Model	1	Instruction model
MAE-7	Drum and Disc Brake (Panel Type)	1	Panel type instruction model
MAE-8	Instruction Model Automatic Transmission	1	Instruction model

5) Production Engineering Laboratory

Code No.	Item	Qty	Specifications
MPE-1	Mechanical Comparator	1	Range:0-50mm, Accuracy: 1.5 μm
MPE-2	Surface Roughness Measurement Instrument	1	Magnification: 1,000x to 50,000x Stroke: 30mm Parameter: Ra, Rq, Ry, Rz

MPE-3	Flatness Interferometer	1	Interference type Field: ϕ150mm
MPE-4	Plug Gauges Ring Gauges	1 set	ϕ 10,20,30,40,50,60,70,80,90,100mm ϕ 10,20,30,40,50,60,70,80,90,100mm
MPE-5	Block Gauges	1 set	60-70 Piece Gauge block set
MPE-6	Taper Plug Gauge	1	MT 1,2,3,4
MPE-7	Thread Gauges of Different Sizes	1 set	ISO 2nd grade coarse thread working gauges 6,10,12,16,42mm

6) Machine Drawing and Design Laboratory

Code No.	Item	Qty	Specifications
MMD-1	Strain Amplifier Demonstration and Measuring System	1	Loading frame, Weights set, Bars for compression and tension, Bar for bending, Bar for torsion, Strain gauge
MMD-2	Sectioned Models of Different Geometrical Solids (1 set)	1	Demonstration models
MMD-3	Bearing Housing	1	Demonstration model
MMD-4	Split Bearing with Separate Shells	1	Demonstration model
MMD-5	Piston with Rings, Piston Rod and Nuts	1	Demonstration model
MMD-6	Connecting rod End with Gib and Cotter	1	Demonstration model
MMD-7	Big End Assembly	1	Demonstration model

7) Heat Transfer Laboratory

Code No.	Item	Qty	Specifications
MHT-1	Water/Water Turbulent Flow Heat Transfer Unit	1	Consisting of Water/water heat exchanger, Water heater, Pump, Flow meter, Digital thermometer

MHT-2	Thermal Radiation Unit	1	Consisting of Plane radiant heat source, Plane rotatable light source, Various kinds of Filters, Light meter, Radiometer and Control panel
MHT-3	Temperature Measurement Unit	1	Platinum resistance thermometer, Thermistor thermometer, Thermocouple thermometer, Vapor pressure thermometer, Mercury-in-glass thermometer
MHT-4	Conductive Heat Transfer Experimental Unit	1	To be able to conduct experiments on Temperature gradient, Cross sectional areas of the conducting path, Thermal conductivity of materials

8) Power Plant Laboratory

Code No.	Item	Qty	Specifications
MPP-1	Water Softening Plant	1	Treatment rate: 1 tons/hour, Manual operation Ion exchange resin type

(3) Department of Civil Engineering

1) Structural and Materials Testing Laboratory

Code No.	Item	Qty	Specifications
CSM-1	Universal Testing Machine	1	Maximum 200 tons Machine which can test and measure the tensile, compression and bending strength and other mechanical characteristics of materials
CSM-2	Structure Testing Machine, Jack System	1	Equipment to test compression load. An oil jack is applied on the upper, left and right sides of frames of rolling steel. Ceiling load: 50 tons, Lateral load: 25 tons
CSM-3	Multipoint Strain Gauge	1 set	Equipment to measure the compression and stress of architectural materials
CSM-4	Set of Sieves with Lid & Receiver	1 set	ASTM standard set of 7 sieves and BS standard set of 7 sieves
CSM-5	Ten Channel Switch & Balance	1 set	To multiply 10 times the range of the existing strain indicator
CSM-6	Prestressing Jack with Gripping Cones	1	Wire tensioning jack for prestressed concrete Tensioning device: 4 column type (double acting oil jack) Mold: 3 wire holes
CSM-7	Crack Detection Microscope	1	To measure hair crack width in concrete structures. Magnification: 35x Range: about 4mm

2) Concrete Laboratory

Code No.	Item	Qty	Specifications
CCL-1	Flexural Strength Testing Apparatus for Small Beams Specimen	1	Loading capacity: 2 stages (1) Maximum 1,000 Lbs (450 kg) (2) Maximum 200 Lbs (90 kg) Loading speed: (1) 600 Lbs/min (270 kg/min) (2) 120 Lbs/min (54 kg/min) Graduation: (1) 5 Lbs, (2) 1 lbs

CCL-2	Poisson's Ratio Measuring Apparatus	1	Measuring instrument of Poisson's ratio of concrete products. Dial gauge, compressometer and extensometer.
CCL-3	Aggregate Crushing Test Set	1	For the crushing test of concrete aggregate. Diameters of cylinder for crushing: 3 and 6 inches. Net weight with piston: 18 kg for 6", 6 kg for 3" .
CCL-4	6" BS Cube Moulds with Tampering Rod & 6"/12" Cylinder Moulds ASTM with Tampering Rod	10 each	Iron cast moulds for concrete moulding
CCL-5	Creep Test Apparatus	1	Creep test apparatus for concrete samples
CCL-6	Thermostatic Curing Tank	1	Maximum temperature: 80 °C Stainless steel tank
CCL-7	Pundit Ultrasonic Concrete Tester complete with 254 kHz Transducers	1	Range of transit time: 0.1-0.999 μ sec Two ranges can be selected with 0.1 μ sec. or 1 μ sec. Batteries: Ni-Cd

3) Soil Mechanics and Highways Laboratory

Code No.	Item	Qty	Specifications
CSH-1	Triaxial Compression Test Set	1	Triaxial chamber: 1 set Axial loading apparatus: 1 set
CSH-2	Electric Unconfined Compression Apparatus	1	Capacity: 50 kg Load measurement: proving ring type
CSH-3	Direct Shear Apparatus	1	Standard load: max 4 kg/cm², min 0.1 kg/cm² Load measurement: proving ring type Capacity: 100 kg
CSH-4	One Dimensional Consolidation Set	1	Consolidometer: fixed type Consolidation load: 0.05-12.8 kg/cm²
CSH-5	CBR Test Set	1	Loading speed: 0.5-1.5mm/min Capacity: max 5 tons

CSH-6	Proving Rings for Compression Machine	1	5 kinds: 100 kg, 200 kg, 500 kg, 2 tons, 5 tons
CSH-7	Constant head Permeameter	1	Inside diameter: 100 mm Height: about 170mm Nickel plated steel tube cylinder
CSH-8	Loading Balance	2	Measurement range: max 6,200 g Graduation: 0.1 g
CSH-9	Motorized Liquid Limit Device	2	Range of drop count: 3 drops Brass plate lined with hard rubber
CSH-10	Falling Head Permeameter	1	Burette of 100 ml.
CSH-11	Shrinkage Limit Determination Equipment	3	Shrinkage dish: 45 mmϕ Dish for mercury: 150 mmϕ Graduated cylinder
CSH-12	Field Soil Density Test Set	1	Portable, sand-cone type
CSH-13	Dial Gauges	10	Graduation: 0.001 mm, Range: 1 mm
CSH-14	Plastic Limit Determination Equipment	3	Consisting of a roll plate, a glass plate and a spatula.

4) Hydraulics and Fluid Mechanics Laboratory

Code No.	Item	Qty	Specifications
CHF-1	Hydraulic Bench	1	To include all instruments to learn the following items: 1. dead weight calibrator 2. hydrostatic pressure 3. flow over weirs 4. metacentric height 5. Bernoulli's theorem demonstration 6. impact of a jet 7. orifice and free jet flow 8. orifice discharge 9. energy loss in pipes 10. flow channel 11. Osborne Reynolds'demonstration 12. flow meter demonstration 13. energy loss in bends 14. free and forced vortices 15. hydraulic ram

CHF-2	Sediment Transport Demonstration Channel	1	To be able to demonstrate the following phenomena. Flow visualization. Bed load movement and suspended sediment transport. Demonstration of local scour at channel obstructions such as bridge piers. Erosion and sedimentation. etc.
CHF-3	Fluid Friction Apparatus	1	Apparatus to learn the following: 1. relation between head loss due to fluid friction and velocity for flow of water. 2. determining the head loss associated with flow through a variety of standard pipe fittings. 3. determining the relationship between pipe friction coefficients and Reynolds' number for flow through a pipe with roughened bore. 4. demonstrating the application of differential head devices in the measurement of flow rate and velocity. 5. practical training on the use of manometers
CHF-4	Laminar Flow Analysis Table	1	Apparatus to learn the following: 1. ideal flow around cylinder 2. ideal flow around an aerofoil 3. ideal flow through a sudden contraction 4. ideal flow through a sudden enlargement

5) Survey Laboratory

Code No.	Item	Qty	Specifications
CSL-1	Theodolite	6	Grade system with 1 minute accuracy, direct reading of scale, magnification 30x
CSL-2	Electronic Total Station	1	Magnification of telescope: 30x Resolving power: 3"

6) Public Health Engineering Laboratory

Code No.	Item	Qty	Specifications

CPH-1	Cooled Incubator for BOD	1	Effective capacity: 250-260 lit. Observation window: triple pane heat absorbing glass window Range of operation temperature: 0°C - +50°C
CPH-2	Top Loading Electronic Balance	1	Range: up to 3,200 g Readability: 0.01 g

(4) Department of Agricultural Engineering

1) Agricultural Machinery and Farm Power Laboratory

Code No.	Item	Qty	Specifications
AMF-1	Carburetor Model	1	Section models, Weber type
AMF-2	Fuel Supply Pump (Diesel) Model	1 set	Section models: electric type and mechanical type
AMF-3	Instruction Model Wankel Engine	1	Section models
AMF-4	Instruction Model Four Stroke Petrol Engine	1	4-cycle engine
AMF-5	Lubrication Pump	1	Section models
AMF-6	Diesel In-line Pump with Fly Weight Governor	1	In-line type, Fly weight governor
AMF-7	Wall Model of Diesel Injection System	1	Panel type
AMF-8	Double Disc Clutch	1	Instruction model
AMF-9	Clutch Coupling	1	Instruction model
AMF-10	Torque Convertor	1	Plastics made, Action models
AMF-11	Hydraulic Clutch	1	Action models
AMF-12	Original Steering Gear with Front Axle	1	Instruction model
AMF-13	Worm Wheel Steering Gear	1	Section models
AMF-14	Disc Brake	1	Instruction models
AMF-15	Hydraulic Brake	1	Instruction models
AMF-16	Diesel Fuel System with Turbo Charger	1	Instruction models
AMF-17	Petrol Fuel System	1	Instruction models
AMF-18	Ignition System Model	1	Instruction models
AMF-19	Cooling system Model	1	Instruction models
AMF-20	Suspension System Model	1	Instruction models, Leaf spring type

AMF-21	Tractor's Electrical System Model	1	Instruction models, Panel type

2) Soil and Water Engineering Laboratory

Code No.	Item	Qty	Specifications
ASW-1	Dial Type Soil Moisture Gauge, Tensiometer	1	Dial type, Range:0-100 cbar
ASW-2	Quick Draw Soil Moisture Probe	1	Length: 305mm, 460mm
ASW-3	Soil Moisture Meter & Resistance Blocks	1	Pressure range: 0-225 Lbs/inch^2
ASW-4	Soil Auger Set	2	To be able to sample soils 1-1.5 m deep
ASW-5	Sieve Analysis Set	2	Seven stage sieve shaker, Sieves: 2mm - 2 μ seven kinds Diameter: 200 mm, Depth: 50 mm
ASW-6	Portable Digital pH Meter	2	Drip proof, Display of pH & temperature, pH range: 0 - 14 (every 0.01pH) Temp.range:0-99.9°C (every 0.1°C)
ASW-7	Electronic Top Loading Balance	2	Range:0-6,200g, Scale:0.1g Diameter of pan: about 160mm
ASW-8	Unit Type Constant Head Permeameter	1	Measuring cylinder Volume: 1,000cc, Minimum interval: Minimum interval: 10 cc Made of nickel
ASW-9	Falling Head Permeameter (Simplified type)	1	Simplified type permeameter, easy to handle and of high accuracy
ASW-10	Soil Testing Kit	5	Portable, To be able to detect NH_4, NO_3, K_2O, CaO, MgO, Fe, Mn, NaCl
ASW-11	Water Quality Testing Kit	1	To be able to measure COD, SS etc.
ASW-12	Pressure Membrane Apparatus	1	15 bar, with ceramic plate extruder
ASW-13	Portable Dial Gauge Soil Thermometer	2	Shield type, Temperature range: -30°C ~ +60°C

ASW-14	Salinity Bridge Measuring Instrument	1	To measure the chlorinity from titration with silver nitrate.
ASW-15	Conductivity/Temperature Meter	1	To measure thermal conductivity and the temperature gradient
ASW-16	Multi-Purpose Water Analysis Meter	1	To test COD, BOD, SS, acids and bases.
ASW-17	Water Level Recorder	1	Range:0-5m, Accuracy:±5mm, Recording period: 45 days
ASW-18	Motorized Liquid Limit Device	1	Display of counts of liquid dropping
ASW-19	Chart Recording Rain Gauge	1	To be able to use for 48 - 72 hours continuously
ASW-20	Digital Thermo/Anemometer	1	Temperature range: 0°C - 40°C Wind force range: 0 - 30 m/s
ASW-21	Irrigation Displays	1	Consisting of twin nozzle, low angle function scale, sprinkler, rain injector, injection adjustor, stand pipe, filters, pressure gauge
ASW-22	Ground Water Flow Unit	1	To draw ground water flow curves

(5) Department of Mining Engineering

1) Mineral Processing Laboratory

Code No.	Item	Qty	Specifications
NMP-1	Water Distillation Apparatus	1	Distilling capacity: 5 lit./hour Deionized water flow rate: 1.5 - 3.5 lit./min
NMP-2	Wet Sieve Analysis Equipment	1	Size: 200 mmϕ, Set of 7 standard sieves
NMP-3	Two Sets of Sieves(ASTM and BS)	2	Set of 7 ASTM standard sieves and Set of 7 BS standard sieves
NMP-4	X-ray Fluorescence Analysis Equipment with Essentials	1	X-ray generator: continuous rating 3 kW Spectroscopic chamber: parallel beam method Counter: scintillation counter, proportional counter
NMP-5	Floatation Cell with Essentials	1	Floating cell: 4,000 ml Stainless steel
NMP-6	pH Meter with extra Glass Electrodes	1	Range: pH0-14(resolution 0.01pH) Temperature range: 0-100°C (resolution 0.1°C) Measuring method: glass electrode method
NMP-7	Automatic Pointer Scale (for 10 kg)	1	Capacity: 10 kg, Minimum division: 20 g To be able to do sampling at a regular interval in the mineral dressing For laboratory use
NMP-8	Automatic Pointer Scale (for 40 kg)	1	Capacity: 40 kg, Minimum division: 100 g To be able to do sampling at a regular interval in the mineral dressing For factory use
NMP-9	Laboratory Furnace	1	Temperature range: 500-1,000°C Temperature control accuracy: ±3°C
NMP-10	Balance	1	Digital display Measurement range: 0-2,000 g Readability: 0.01 g
NMP-11	High Speed Blender	1	Variable speed

NMP-12	Thermostatic Water Bath	1	Temperature range: room temperature+5°C ~ boiling temperature (water) Temperature control:±2.5°C Capacity: 10 ~ 12 lit.
NMP-13	Ultrasonic Bath	1	Capacity: about 6 lit.
NMP-14	Roll Crusher	1	Feed size: 9 ~ 10 mm Product size: 2.5 - 3 mm Capacity: 2 - 3 tons/hour One roll type

2) Rock Mechanics Laboratory

Code No.	Item	Qty	Specifications
NRM-1	Direct Shear Test Apparatus	1	To test shearing strength of rocks
NRM-2	Strain Gauge Meter	1	Portable, For measuring static strain of rock samples
NRM-3	White Source Lamp	4	300 W. Spares for the existing equipment
NRM-4	Mercury Lamp	4	75 W. Spares for the existing equipment
NRM-5	Rock Sample Grinder	1	To be able to do grinding and polishing. To be able to grind so that the upper part of core boring samples may have the same diameter as the lower part.
NRM-6	Core Drilling Machine	1	Variable speeds of revolution To be able to drill vertically as well as horizontally
NRM-7	Core Barrels	8	Diameter: 3 - 4 inches Length: 0.8 - 1.0 m Drill bits: surface and impregnate
NRM-8	Schmidt Hammer	1	To measure hardness from the coefficient of restitution by striking concrete blocks or rocks. Length: about 320 mm Diameter: 100 mmϕ
NRM-9	Dial Vernier Calliper	2	Range: 0-100 mm; Accuracy: ±0.05mm Dial: about 50 mm ϕ

3) Mine Surveying Laboratory

Code No.	Item	Qty	Specifications
NSV-1	Automatic Routine Level (30x)	1	Telescope magnification: 30x Resolving power: 3" Compensator working range: ±15' Sensitivity of circular level: 10'/2 mm
NSV-2	Automatic Routine Level (26x)	1	Telescope magnification: 26x Resolving power: 3.5" Compensator working range: ±15' Sensitivity of circular level: 10'/2 mm
NSV-3	Mining Suspension Theodolite	1	Telescope magnification: 18x Sensitivity of telescope level: 30'/2 mm Relative luminance:3 Complete water proof
NSV-4	Special Thermometer	1	Accuracy: ±(full scale x 0.3% + 1°C) Range: -160°C - +1,372°C Battery operated Sealed type
NSV-5	Stainless Steel Tape	3	Length: 100 m
NSV-6	Distance Meter	1	To be able to measure both horizontal and vertical distance. Accuracy:±5 mm Handy and easy to handle
NSV-7	Altimeter	1	Altitude about 2,500 m
NSV-8	Laser Control Theodolite	1	Telescope magnification: 30x He-Ne gas laser Resolution: 3"
NSV-9	Binocular	2	Magnification: 8x Diameter of object lens: 30 mmϕ

4) Drilling Technology Laboratory

Code No.	Item	Qty	Specifications
NDT-1	Wire Line Core Barrel	1	Sectioned model for demonstration. Complete with all constituent parts from bit to spearhead.

NDT-2	Marsh Funnel	1	Funnel: diameter 3/16 inches, height 2 inches, total height 12 inches Viscosity measuring cup of stainless steel or plastics Mud sample amount: 1,500 cm^3
NDT-3	Diamond Bits	3 sets each	Bits: impregnate bits:3sets surface set bits: 3 sets Diameter of bit: 87 mm and 102 mm

5) Mine Safety Laboratory

Code No.	Item	Qty	Specifications
NMS-1	Portable Equipment for CO, CO_2 Detection	1	To measure concentration of O_2, CO, CO_2 in gases. Digital display Continuous measurement
NMS-2	Portable Interferometer	1	Vernier graduations range: 0-100% CH_4 with 0.2% vernier graduations
NMS-3	Multigas Detector	1	For detecting inflammable gas leakage Accuracy: ±5% of full scale
NMS-4	Oil Flame Safety Lamp	4	Safety lamp not ignited in inflammable gas air mixtures
NMS-5	Wet & Dry Bulb Hygrometer with Carrying Case	2	With thermometer and wicks
NMS-6	Portable Aneroid Barometer	2	Range: 915-1,045 mb (graduation 1 mb)

6) Mine Ventilation Laboratory

Code No.	Item	Qty	Specifications
NMV-1	Wind Tunnel with Fan	1	Equipment to learn the following: 1.investigation of the development of the boundary layer on a flat plate. 2.flow visualization studies around an aerofoil. 3.measurement of pressure distribution around an aerofoil at various angles of attack. 4. measurement of pressure distribution around a cylinder. 5.estimation of drag coefficients of an aerofoil or a cylinder.
NMV-2	Self Contained Breathing Apparatus	1	Breathing bag capacity: about 5-6 lit. Breathing cylinder capacity: about 2 lit. Life time: about 4 hours
NMV-3	Pipe Friction/ Fluid Friction Apparatus	1	Equipment to learn the following: 1. using manometers to measure pressure drop 2. using a pitot-static tube to measure flow 3. using nozzles and orifices to measure flow 4. understanding and measuring velocity profiles 5. relating pressure loss in a duct to flow rate 6. measuring the flow resistance of duct fittings 7. understanding the use of Reynolds numbers 8. measuring the dispersion of a jet
NMV-4	Digital Luxmeter	1	LCD display Range: 0-19,999 lux Accuracy: ±7%
NMV-5	Geiger Counter	1	Portable, digital display

7) Geology Laboratory

Code No.	Item	Qty	Specifications
NGL-1	Polarizing Microscope	1	Binocular microscope

NGL-2	Crystal and Atomic Structure Model Set of Six Models	3	Size of each model: 150-250 mm Crystals: isometric, hexagonal, tetragonal, orthorhombic, triclinic, Atomic structure model Demonstration model able to fabricate.
NGL-3	Mountain Models	1	Demonstration model Consisting of conformable and unconformable strata models, faults models (normal, reverse and step), demonstration of the mechanism of earthquakes caused by mantle convection.
NGL-4	Geological Thin Section Preparation Apparatus	1	Equipment to prepare thin sections from mineral samples
NGL-5	Geological Hammer	1	Hammer and chisel for geological survey

(6) Department of Basic Sciences

1) Physics Laboratory

Code No.	Item	Qty	Specifications
BPL-1	Geiger-Muller Counter with GM Tube Source Kit	1	Accessories including solid state detector, pre-amplifier, photo diode assembly with light sources, photo timing support assembly, Geiger Muller tube holder and lead, coaxial interconnecting cable, universal castle, absorbers (minor set), absorbers(intermediate set)
BPL-2	Microwave Transmitter & Reflecting Plates	1	Microwave transmitter with klystron, spare klystron, microwave power supply(220 AC), microwave receiver, LF amplifier, diode 1N415C, microwave receiving dipole, special sleeve. accessories: reflector plate(for diffraction & interference experiments) polarization grid (to demonstrate polarization of microwaves), circular metal plate (for diffraction experiments), convergent lens,
BPL-3	DC Power Supply	1	Variable 20 - 250 V, 1 kW, ± 0.1V
BPL-4	H.T. Power Supply	1	Outputs:100V to 5kV, DC short circuit, current 3mA; 100V to 5kV, DC current, limited to 60 microampere
BPL-5	Electrometer	3	To measure electric properties of dielectrics
BPL-6	Auto Variable Transformer	3	Input voltage 240V 50-60Hz Output voltage 0 to 240V Output current up to 3A

2) General Chemistry Laboratory

Code No.	Item	Qty	Specifications
BGC-1	Laboratory Centrifuge	2	Max speed: 5,000 rpm, Centrifugal force: 4,500g Rotor type: 15ml x 24 Angle Rotor radius: 15-20 cm Tubes

BGC-2	Magnetic Stirrer	5	Different stirring capacities 0.1 - 5 lit. with water bath
BGC-3	Flask Shaker	2	A fixed type for 36 test tubes and a multipurpose fixed type
BGC-4	Drying Oven	2	Temperature range 40 - 250°C, Capacity ~ 160 lit.
BGC-5	Thermostat	1	Temperature range 25 - 250°C
BGC-6	Hot Plate	1	Temperature range 50 - 250°C, Temperature control ±10 °C
BGC-7	Water Bath	2	Temperature range ~5 - ~90 °C,
BGC-8	Heating Mantle	5	200 ml x 2, 500 ml x 3
BGC-9	Chamber Furnace	1	Temperature range 25 - 1,200 °C
BGC-10	Vacuum Pump	2	Gaede type 2 stages, Vacuum level: 0.0005 Torr No. of revolution:~1,500 rpm Exhaust capacity: ~ 150 lit./min Diameter of air intake tube: about 30 mm
BGC-11	Rotary Vacuum Evaporator	2	Speed range 50 - 200 rpm Temperature 5 - 35 °C, with water bath

3) Analytical Chemistry Laboratory

Code No.	Item	Qty	Specifications
BAC-1	Atomic Absorption Spectrophotometer	1	Flame emission, expandable to flameless
BAC-2	An Arrangement for Potentiometric Titrations	1	An arrangement for potentiometric titrations containing a titration cell made of glass with lid having inlets for electrodes, inert gas and pneumatic pipette (air operated capable of delivering fixed volumes of aliquots). Such Titrations are usually carried in a constant temperature bath. The arrangement also contains a magnetic stirrer inside the constant temperature bath.

BAC-3	Digital Voltmeter to measure pH	1	Digital voltmeter capable of measuring the voltage with ±0.1mV with cables for connection with a glass calomel or combination electrodes
BAC-4	Teflon Beakers with lids and stirrers	24	200 ml x 12, 300 ml x 12
BAC-5	Platinum Crucibles	6	Capacity 10-15 ml with lids
BAC-6	Electrolysis Apparatus	1	Complete with two pairs of electrodes and other accessories
BAC-7	UV Spectrophotometer	1	Visible
BAC-8	Polarograph	1	Complete with accessories, e.g. hanging mercury drop electrode (HMDE) and graphite electrode, recorder etc.
BAC-9	Gas Analysis Apparatus	1	Standard
BAC-10	Conductivity Meter	1	Digital display, measuring method: operational amplifier output: conductivity 0 to 1 V F.S. temp. 0 to 1 V

4) Special Laboratory

Code No.	Item	Qty	Specifications
BSL-1	Distillation Apparatus for Fuel	1	Based on ASTM D-2892
BSL-2	Tar Viscometer	1	With standard accessories
BSL-3	Carbon Residue Tester	1	Standard type
BSL-4	Abbe Refractometer	1	Standard type
BSL-5	Polarimeter	1	Standard type
BSL-6	Pressure Gauge (Bourdon type)	1	Diameter about 125mm

5) Computer Room

Code No.	Item	Qty	Specifications
BCC-1	Personal Computers	30	CPU: Intel 80386 or the above RAM >= 2 MB, At least one floppy disk drive 3.5" Hard disk >= 40 MB 14" Color VGA display, Keyboard, MS-DOS 5.0 or higher, Stabilizer
BCC-2	Printers	15	Dot matrix, Paper width up to 364 mm

(7) Workshop

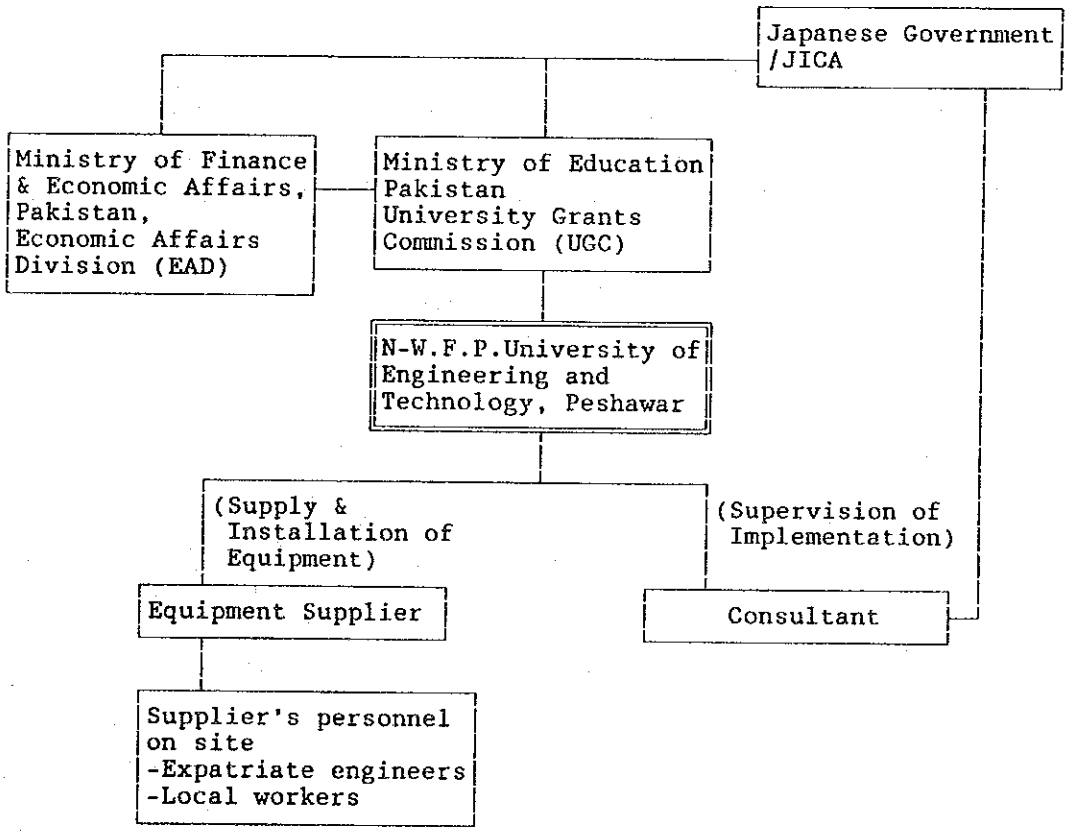
Code No.	Item	Qty	Specifications
UWL-1	Universal Milling Machine	1	Vertical type, #1 or #2, knee type Accessories: vertical head
UWL-2	Numerically Controlled Lathe	1	Maximum swing diameter: 360 mm (on the bed) Distance between centers: 410 mm

4.4 Implementation Plan

4.4.1 Implementation Method

The project consists of the works of buildings and facilities which are to be done by the Pakistan side and the provision of equipment through a Grant Aid of the Japanese Government. The executing agency, the N-W.F.P. University of Engineering and Technology, Peshawar will enter into a contract with a Japanese consultant which executes the detailed design, the preparation of a tender, the tender evaluation and the supervision of execution of equipment installation in lieu of the University. A chart of the project execution organizations is shown in Fig. 4.4.1.

Fig. 4.4.1 Project Implementation Organization



4.4.2 Points to be considered in the Execution

The time of installation of equipment and dispatch of installation engineers must be arranged so as to avoid waiting time on the spot

4.4.3 Plan for Supervision of the Implementation

The consultant shall carry out the detail design and supervise the tendering procedure and the project execution. During the implementation of the work the consultant may, whenever necessary, arrange for a supervisor to be present on the spot at the time of

- approval of the manufacturing design of equipment.
- pre-shipment inspection at a factory.
- installation and inspection of equipment at delivery.

The consultant shall also be informed on the progress of works to be done in Pakistan. When some delays are occasioned the consultant shall advise the Pakistan side of necessary steps to take if required.

4.4.4 Equipment Procurement Plan

(1) Procurement Plan

Procurement of equipment will be done under a lump sum contract with a supplier of equipment (trading company) which is a successful bidder in the competitive bidding. In principle Japanese products will be procured. However, some third country products will be procured.

Personal computers can be purchased easily in Pakistan and reliable maintenance and training services are available locally. Therefore it is desired to purchase computers in Pakistan. At present the University has IBM compatible machines and has an agreement with IBM on a package maintenance service. It is desirable to utilize such an existing maintenance and management system for the effective use of equipment provided through this project.

(2) Transportation

The equipment will be shipped from a port near the place of production all at once or separately at different times and landed at the port of Karachi. It will be transported on the road or on the railway from Karachi to Peshawar. The custom clearance is desired to be made at the dry port in the suburbs of Peshawar, but may be made at the port of Karachi as well. If the clearance is made at the dry port, the equipment will be transported on the road from there to the University.

4.4.5 Scope of the Work

(1) Scope of the Work of the Japanese Side

1) Procurement of equipment and materials, and transportation and installation related hereto.

2) Electrical wiring work from a socket in the laboratory to the installed equipment (however, a socket must be close to the equipment to be installed and the wiring work from a power source to the socket shall be done by the Pakistan side).

3) Test operation and adjustment of equipment. Instruction of operation and maintenance.

4) Consulting services including preparation of tender documents, management of tendering and supervision of the project implementation.

(2) Scope of the Work of the Pakistan Side

1) Civil work for the buildings contemplated to install the equipment, interior work of the building, foundation work of the equipment, and relocation work of the existing equipment and facilities.

2) Electric work for receiving, transforming and distributing electric power.

3) Plumbing work for water and drainage, and fuel gas work.

4) Electric lighting work.

5) Air conditioning work.

6) Draft and ventilation work.

7) Telephone and communication facility work.

8) Utensils and furniture.

9) Chemicals and consumables.

10) To take necessary measures for the unloading, custom's clearance and inland transportation of equipment, and to bear all the expenses necessary hereto.

11) To proceed with approvals necessary to carry on the project.

12) To bear commissions to a foreign exchange bank officially recognized by the Japanese Government for the banking services based on the Banking Arrangement.

13) To accord Japanese nationals whose service may be required in connection with the project such facilities as may be necessary for their entry into Pakistan and stay therein for the performance of their work.

14) To maintain and use properly the equipment purchased under the Grant Aid.

15) To bear all other expenses which are not included in the Grant Aid agreement but may be necessary to carry out the project

4.4.6 Implementation Schedule

In the implementation of project through a Grant Aid of the Japanese Government, the project shall be executed in the following sequences.

(1) Detail Design

The consultant prepares the detailed design based on the basic design, prepares the tender documents, issues the public notice of tender invitation, gives advice to the University during the contract negotiations and witnesses the contract. It will take about three months from the detail design to the signing of contract.

(2) Manufacturing and Works

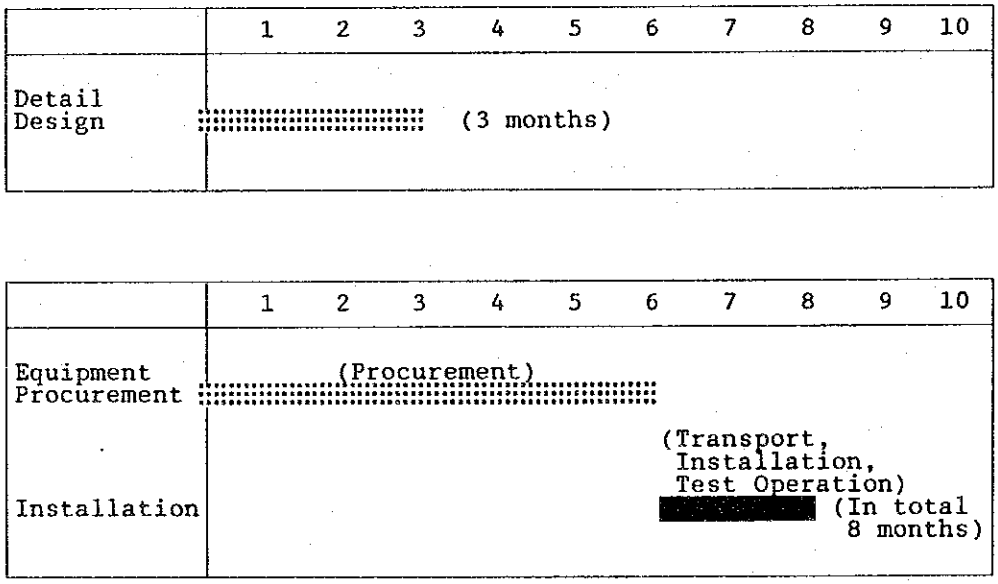
The supply contractor arranges the documents of approval for manufacturing of equipment, manufactures equipment, and ships the equipment to Pakistan. The supply contractor executes all the works in Pakistan (unloading, inland transportation and installation of equipment) until the test operations of equipment is completed at the installed site.

(3) Completion of the Work

In the presence of the University authorities, the consultant and other parties concerned, the installed equipment is test operated and confirmed that it conforms to the specifications, and then delivered to the Pakistan side. The Pakistan side issues certificates of the completion of the work to the supply contractor and the consultant. All the works will be completed in eight months after the contract is placed if the works go as planned.

The implementation schedule is shown in Fig. 4.4.2.

Fig. 4.4.2 Implementation Schedule



4.4.7 Costs for the Pakistan Side

The costs of the work to be born by the Pakistan side will be about 3.9 million Rupees. The breakdown is as follows:

	(million Rupees)
Remodeling, repair, foundation work	0.41
Utility work	2.12
Air conditioning work	0.09
Office equipment, appliances	0.28
Others	1.00
Total	3.90

CHAPTER 5 PROJECT EVALUATION AND CONCLUSION

Chapter 5 Project Evaluation and Conclusion

5.1 Project Evaluation

The Government of the Islamic Republic of Pakistan is developing human resources in the Seventh Five Year Plan placing emphasis on education and training, and is making efforts to upgrade the existing universities and colleges and to improve academic facilities and equipment in order to modernize the country and to develop the industry. The purpose of this project is to improve and expand the experimental equipment of the N-W.F.P. University of Engineering and Technology, Peshawar, where most pieces of equipment are old and obsolete, and to enable the University to provide industries with graduates who will meet expectations of the industries. The Table 5.1.1 summarizes the present situation of the University and how this project will improve it and achieve the purpose mentioned above.

Table 5.1.1 Results and Degree of Improvement to be effected by the Project Implementation

Present Situation and Problems	Measures of This Project	Expected Results and Level of Improvement
1) Most pieces of the existing equipment for experiments at the N-W.F.P. University of Engineering and Technology, Peshawar are old and obsolete. The quantity and kinds have not increased in proportion to the increase of students and laboratories are not equipped adequately to provide the higher engineering education which can keep step with the progress of technology.	1) To equip the laboratories with necessary quantity of the instruments which are adequate to the present higher engineering education and facilitate experiments to teach the underlying principles and applications of technology.	1) The project will help the University to provide the engineering education which not only teaches underlying principles but also keeps pace with the progress of technology. Graduates educated in the improved environment are expected to contribute to the economic development of Pakistan, to increasing the competitiveness of Pakistan products in world markets and to raising the living standards of Pakistan people.
2) That the equipment is old and obsolete does not give incentives to the teachers and technical staff for teaching and discourages students to study further. The present engineering educaion is not satisfactory.	2) To provide new types of educational equipment which incorporate the progress of technology.	2) The introduction of new equipment which reflects the present-day technological innovation requires not only students but also teachers to study the operation and maintenance of new equipment and other related techniques. This will activate engineering education of the University and upgrade the technical capability of the University. Thus the reputation of the University as a higher engineering institution will spread in Pakistan and the University will attract better students. All this will contribute to the development of the University, the development of industries in the Province and the development of Pakistan.
3) Most pieces of the existing equipment are too old and obsolete to conduct experiments and testing which the industry requests. Such technical services as consulting services, contract researches for public organizations are not satisfactory.	3) To select versatile and various kinds of equipment	3) Many kinds of new equipment of high performance will make it possible for teachers to conduct various kinds of experiments and testings. Requests will increase from industries for testings and contract researches. Cooperation of the University with industries will increase and the University will be able to provide industries with better technical advice and to expand technical assistance to public organizations.

5.2 Conclusion

The development of human resources is a key to the modernization of Pakistan and the promotion of industry. In particular, the development of human resources in engineering and technology is urgently required. This project is expected to raise the standard of technology of the University and will contribute to the industrial development of the Province, to raising the living standards of the country and to the development of Pakistan as a whole. These benefits will justify to implement this project by a Grant Aid of the Japanese Government. There will be no problem with the organization, manpower and funds of the Pakistan side in execution of the project. However, the following measures are necessary to be taken by the Pakistan side in order to implement the project as planned.

(1) Execution of the Works on the Pakistan Side

The remodeling of laboratories which accommodate new equipment, the electricity work, the gas fitting work, and the water supply and drainage works need to be done as planned. Procedures necessary for the unloading, custom clearance, inland transportation and installation of equipment must be taken promptly so that the contractor can secure safety and prevent damage to the equipment until the whole process is completed.

(2) Budget for Maintenance Fees

It is indispensable to secure a certain amount of funds to pay for maintenance fees in order to maintain equipment in good working condition. It is necessary for the Government and University to earmark a budget for the maintenance of equipment.

(3) Training of Staff

Proper placement of laboratory technical staffs and their training are necessary to operate and maintain equipment in a proper way. A management system for the operation and maintenance of equipment must be established and the staff members must be trained in step with the installation of equipment.

(3) Maintenance Plan

A certain amount of spare parts and consumables necessary to operate equipment must always be available at hand and be replenished if necessary. The inventory of these things must be kept in order. The staff members who operate and maintain equipment must understand instruction manuals of equipment and someone must be responsible for keeping the instruction manuals in order.

APPENDICES

APPENDIX-1 MEMBERS OF THE BASIC DESIGN STUDY TEAM

Dr. Nobuaki Otsuki (D. Eng.)	Team Leader, Associate Professor, Faculty of Engineering, Tokyo Institute of Technology
Shinji Kure	Equipment Planning for Engineering Education (Leader of Consultant), UNICO International Corporation
Tatsuo Kumekawa	Equipment Planning (Civil, Mining Engineering), UNICO International Corporation
Dr. Yasuo Shibata	Equipment Planning (Mechanical, Agricultural Engineering), UNICO International Corporation
Takashi Kuroda	Engineering Planning (Electrical Engineering, Basic Sciences), UNICO International Corporation
Wataru Shiga	Equipment Layout and Cost Estimation, UNICO International Corporation

APPENDIX-2 SCHEDULE OF THE FIELD SURVEY
(Sep.28,1992 - Oct.17,1992)

1.	Sep. 28th (Mon.)	Lv. Tokyo (Mr. Kure, Mr. Kumekawa, Dr. Shibata, Mr. Kuroda, Mr. Shiga) Ar. Islamabad
2.	Sep. 29th (Tue.)	(Islamabad) -Courtesy meeting at the Embassy of Japan and JICA Pakistan Office -Survey at the Geoscience Laboratory
3.	Sep. 30th (Wed.)	(Islamabad) Courtesy call on MOE and UGC Lv. Islamabad Ar. Peshawar
4.	Oct. 1st (Thu.)	(Peshawar) Meeting with the teaching staff of UETP
5.	Oct. 2nd (Fri.)	(Peshawar) -Team meeting -Data arrangement
6.	Oct. 3rd (Sat.)	(Peshawar) Meeting with the teaching staff of UETP
7.	Oct. 4th (Sun.)	(Peshawar) Meeting with the teaching staff of UETP
8.	Oct. 5th (Mon.)	(Peshawar) Meeting with the teaching staff of UETP
9.	Oct. 6th (Tue.)	(1) (Peshawar) Meeting with the teaching staff of UETP (2) Lv. Tokyo (Dr. Otsuki) Ar. Karachi

10. Oct. 7th (Wed.)

(1) (Peshawar)
Meeting with the teaching staff of UETP

(2) Lv. Karachi (Dr. Otsuki)
Ar. Islamabad

(3) Lv. Peshawar
(Mr. Kure, Mr. Shiga)
Ar. Islamabad

(4) (Islamabad)
Courtesy meeting at the Embassy of Japan and JICA Pakistan Office

11. Oct. 8th (Thu.)

(1) (Peshawar)
Meeting with the teaching staff of UETP

(2) (Islamabad)
Courtesy call on MOE, UGC and EAD

(3) Lv. Islamabad
(Dr. Otsuki, Mr. Kure, Mr. Shiga)
Ar. Peshawar

12. Oct. 9th (Fri.)

(Peshawar)
-Team meeting
-Data arrangement

13. Oct. 10th (Sat.)

(Peshawar)
-Courtesy call on the Vice-Chancellor of UETP
-Survey of the campus of UETP

14. Oct. 11th (Sun.)

(Peshawar)
-Overall meeting with the staff of UETP and MOE
-Signing of the Minutes of Discussions

15. Oct. 12th (Mon.)

(Peshawar)
Meeting with the teaching staff of UETP

16.	Oct. 13th (Tue.)	(Peshawar) Visit to Frontier Ceramics Limited and Omer Glass Industries Ltd.
17.	Oct. 14th (Wed.)	Lv. Peshawar (Dr. Otsuki, Mr. Kure, Mr. Kumekawa, Dr. Shibata, Mr. Kuroda, Mr. Shiga) Ar. Islamabad
18.	Oct. 15th (Thu.)	(Islamabad) Courtesy call on the Embassy of Japan, JICA, MOE and EAD
19.	Oct. 16th (Fri.)	Lv. Islamabad Ar. Bankok
20.	Oct. 17th (Sat.)	Lv. Bankok Ar. Tokyo

Legend :

MOE : Ministry of Education
UGC : University Grants Commission
EAD : Economic Affairs Division
UETP : N-W.F.P. University of Engineering and Technology, Peshawar

APPENDIX-3 LIST OF INTERVIEWED PERSONNEL

N-W.F.P. University of Engineering and Technology, Peshawar

Engr. Karim Khan, Vice-Chancellor
Mr. Mohd. Sarwar Khan, Director Finance & Planning
Mr. Humayun Zia, Registrar (Prof.)
Mr. M.A. Razvi, Dean, Fuculty of Engineering (Prof.)
Dr. M. Javaid, Professor, Chairman Basic Sciences
Mr. Azizur Rahman, Professor, Chairman Civil Eng'g
Engr. Tariq Naseem, Assoc.Prof., Chairman Mining Eng'g
Dr. Mohammad Mansoor Khan, Proffessor, Mining Eng'g
Engr. Mumtaz Khan, Director of Works
Dr. M.A. Baseer, Chairman Mechanical Eng'g
Mr. Asar Khan, In-charge University Workshops
Mr. Mohammad Qaid, Chairman Electrical Eng'g
Mr. Mohammad Nisar, Controller of Examination
Mr. Badruddin, Prof., Chairman Agricultural Eng'g
Dr. M. Abdullah, Professor, Electrical Eng'g

Ministry of Education

Mr. Munir Ahmad, Joint Ed. Advisor, Planning
Mr. A.D. Khan, Deputy Ed. Adviser, Planning
Mr. Mohd. Ibrahim Khan, Deputy Ed. Advisor, Univ. Ed.

University Grants Commission

Mr. Saeed Ullah Shah, Advisor (Financial & Planning)
Mr. Rafique Ahmad, Advisor (Academics)

Economic Affairs Division

Mr. Ahmad Shamsul Huda, Joint Secretary
Mr. Faiz Ur Rahman, Section Officer

Frontier Ceramics Ltd.

Mr. Fazle Khaliq, Managing Director

Omer Glass Industries Ltd.

Mr. Abdul Waheed Khan, General Manager

Embassy of Japan

Mr. Koichi Murase, First Secretary

JICA Pakistan Office

Mr. Akihiro Mitarai, Resident Representative
Mr. Kaoru Iwasaki, Assist. Resident Rep.
Mr. Mahmood A. Jilani, Chief Programme Officer

Geoscience Laboratory - Geological Survey of Pakistan

Mr. S. Hasan Gauhar, Project Director
Dr. Teruo Shirahase, Leader of Japanese Experts
Dr. Jiro Hirayama, Expert
Mr. Mononobe, Expert
Mr. Toshio Ueno, Coordinator, JICA

MINUTES OF DISCUSSIONS

BASIC DESIGN STUDY ON THE PROJECT FOR EDUCATIONAL EQUIPMENT FOR THE N-W.F.P. UNIVERSITY OF ENGINEERING AND TECHNOLOGY, PESHAWAR IN THE ISLAMIC REPUBLIC OF PAKISTAN

In response to a request from the Government of the Islamic Republic of Pakistan, the Government of Japan decided to conduct a Basic Design Study on the Project for Educational Equipment for the N-W.F.P. University of Engineering and Technology, Peshawar (hereinafter referred to as "the Project"), and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Pakistan a study team , which is headed by Dr. Nobuaki Otsuki, Associate Professor, Faculty of Engineering, Tokyo Institute of Technology, and is scheduled to stay in the country from September 28 to October 16, 1992.

The team held discussions with the officials concerned of the Government of Pakistan (hereinafter referred to as "the Pakistan side") and conducted a field survey at the study area.

In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The team will proceed to further works and prepare the Basic Design Study Report.

Peshawar, October 11, 1992.

Dr. Nobuaki Otsuki
Leader,
Basic Design Study Team
JICA.

Engr. Karim Khan,
Vice-Chancellor,
N-W.F.P. University of
Engineering. & Technology
Peshawar.

Mr. Saeedullah Shah,
Adviser,
(Finance & Planning),
University Grants Commission, Islamabad.

Mr.A.D. Khan,
Deputy Educational Adviser,
Ministry of Education, Islamabad.

ATTACHMENT

1. Objective

The objective of the Project is to help strengthening the academic facilities of the N-W.F.P. University of Engineering and Technology, Peshawar by supplying educational equipment to the University.

2. Project Site.

The Project site includes whole campus of the N-W.F.P. University of Engineering and Technology, Peshawar.

3. Executing Agency.

The N-W.F.P. University of Engineering and Technology, Peshawar is responsible for the execution of the Project, while the Ministry of Education is responsible for the administration of the Project.

4. Items Requested by the Government of Pakistan.

After discussions with the Basic Design Study Team, the following items were finally requested by the Pakistan side.

(i). Provision of equipment and spare parts for the following teaching departments;

- Department of Civil Engineering.
- Department of Electrical Engineering.
- Department of Mechanical Engineering.
- Department of Agricultural Engineering.
- Department of Mining Engineering.
- Department of Basic Sciences.
- University Workshops.

(ii). Provision of services for the implementation of the Project.

However, final components of the Project will be decided after further studies.

5. Japan's Grant Aid System

(i). The Pakistan side has understood the system of Japanese Grant Aid explained by the team.

(ii). The Government of Pakistan will take necessary measures, described in the Annex for smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. Schedule of the Study.

Based on the Minutes of Discussions and technical examination of the study result, JICA will complete the final report and send it to the Government of Pakistan by February 1993.

Annex: Necessary measures to be taken by the Government of the Islamic Republic of Pakistan in case Japan's Grant Aid is executed.

1. To arrange the appropriate building with facilities of electricity, water supply, drainage, etc. whatever necessary for housing and operating the equipment and spare parts, before commencement of equipment installation work.

2. To ensure prompt unloading, exempt taxes, and take necessary measures for custom's clearance at ports of disembarkation in Pakistan of the equipment provided under the Grant Aid.

3. To bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.

4. To accord Japanese nationals whose services may be required in connection with supply of products and services under the verified contract such facilities as may be necessary for their entry into Pakistan and stay therein for the performance of their work.

5. To exempt Japanese nationals involved in the Project from custom's duties, internal taxes and other fiscal levies which may be imposed in Pakistan with respect to the supply of equipment and services under the verified contract.

6. To maintain and use properly the equipment purchased under the Grant Aid.

7. To bear all the expenses other than those to be borne by the Grant Aid, necessary for the execution of the Project.

APPENDIX-5 LIST OF EQUIPMENT REQUESTED

DEVELOPMENT OF LABORATORIES

1. DEPARTMENT OF CIVIL ENGINEERING

a) EQUIPMENT FOR SOIL MECHANICS LABORATORY

S.NO.	ITEM DESCRIPTION	PART NO/ SET NO.	QUANTITY REQUIRED	PRICE RS.	
1.	Dial Guage	EL 20-150	12	Rs.	5,000.00
2.	Loadings (Proving Ring)				
3.	450 Kg	EL 20-030	2	Rs.	1,000.00
4.	700 Kg	EL 20-040	2	Rs.	1,000.00
5.	1000 Kg	EL 20-050	2	Rs.	1,000.00
6.	1400 Kg	EL 20-060	2	Rs.	1,000.00
7.	2000 Kg	EL 20-070	2	Rs.	1,000.00
8.	2800 Kg	EL 20-080	2	Rs.	1,000.00
9.	General purpose Oven (200 C)	EL 22-132/1	2	Rs.	20,000.00
10.	(250 C)	EL 22-133/1	2	Rs.	20,000.00
11.	(300 C)	EL 22-138/1	2	Rs.	15,000.00
12.	Hot Plate (200 W)	WL 22-310/1	2	Rs.	10,000.00
13.	Mettor Top Loading Balance	EL 22-605/1	2	Rs.	20,000.00
14.	Mettor Top Loading Balance	EL 22-608/1	1	Rs.	20,000.00
15.	Studoas Balance	EL 22-700	1	Rs.	5,000.00
16.	Field and Laboratory Scale	EL 22-730	2	Rs.	20,000.00
17.	Field and Laboratory Scale	EL 22-745	2	Rs.	20,000.00
18.	Counter Scale (without Wt.Box)	EL 22-770	2	Rs.	15,000.00
19.	Riffing Box ASTEM D 421	SET 2310	1	Rs.	25,000.00
20.	Mioture content determination	SET 2320	2	Rs.	20,000.00
21.	Liquid limit determination	SET 2410	2	Rs.	30,000.00
22.	Motorised liquid limit device	EL 24-19/1	2	Rs.	40,000.00
23.	Plastic limit determination.	SET 2420	4	Rs.	30,000.00
24.	Shrinkage limit determination	SET 2430	4	Rs.	30,000.00
25.	Sand Equivalent Value	SET 2435/1	2	Rs.	25,000.00
				Rs.	3,76,000.00

			B.F.		3,76,000.00
S.NO.	ITEM DESCRIPTION	PART NO/ SET NO.	QTY	PRICE RS.	
26.	Specific Gravity of Soil.	SET 2438	1	Rs.	5,000.00
27.	Grain size analysis	SET 2448/1	2	Rs.	20,000.00
28.	Sulphate content in soil	SET 2466	1	Rs.	10,000.00
29.	Sulphate content in water	SET 2467	1	Rs.	10,000.00
30.	Unconfined compression.	SET 2510/1	2	Rs.	30,000.00
31.	Undrain Triaxial Test.	SET 2515/1	2	Rs.	40,000.00
32.	Undrain Triaxial test.	SET 2600/1	2	Rs.	40,000.00
33.	Direct Shear test.	SET 2805/1	2	Rs.	20,000.00
34.	One Dimension/consolidation	SET 2810	2	Rs.	20,000.00
35.	Permeability of soil/content Head	SET 2815	2	Rs.	10,000.00
36.	Permeability of soil/variable head	SET 2825	2	Rs.	15,000.00
37.	Vacuum pump for permeability	EL 81-070	2	Rs.	10,000.00
38.	Moisture density Relation, of soil	SET 2840	2	Rs.	15,000.00
39.	Proctor Mould	EL 28-600	2	Rs.	10,000.00
40.	Standard compaction Rammer	EL 28-604	2	Rs.	20,000.00
41.	Automatic Compactor	EL 28-629	2	Rs.	10,000.00
42.	C.B.R. test in Laboratory	SET 2910/1	2	Rs.	30,000.00
43.	C.B.R. in field.	SET 2913	2	Rs.	15,000.00
44.	Field Density test	SET 2926	2	Rs.	10,000.00
45.	Sand Cone	EL 29-430	4	Rs.	12,000.00
46.	Plastic container	EL 29-432	4	Rs.	16,000.00
47.	Density Plate	EL 29-434	4	Rs.	16,000.00
48.	Density chisel	EL 29-506	8	Rs.	5,000.00
49.	Extruder	EL 23-425	2	Rs.	10,000.00
50.	Adopter set	EL 23-430	2	Rs.	16,000.00
51.	Hand operated extruder	EL 23-459	1	Rs.	5,000.00
52.	38 mm adopter.	EL 23-466	1	Rs.	5,000.00
53.	Adopter.	EL 23-470	1	Rs.	5,000.00
			Total	Rs.	8,06,000.00

b) EQUIPMENT FOR PROPOSED CONCRETE LAB:

TECHNOTEST

1.	At 280/%	Capping compound 25 Kg.	Rs.	5,000.00
2.	AP 030	Multiple Amplifier for load cells	Rs.	5,000.00
3.	APO 030/1	Presetting for the operation of the amplifier (AP 030)	Rs.	5,000.00
4.	AP 028/A	10,000 Lg (100 Kn) Electronic load cell (Quantity-2 Nos).		
5.	AP 027/A	30,000 Kg (300 KN) Electronic load cell (Quantity - 2 Nos)	Rs.	8,000.00
6.	AP 004	Flexural strength testing apparatus	Rs.	5,000.00
7.	AP 002	Tensile stress testing apparatus.	Rs.	15,000.00
8.	Ap 003	Tensile stress and flexural strength testing apparatus.	Rs.	10,000.00
9.	AT 278	Compressonmeter.	Rs.	15,000.00
10.	AT 278/S	Compressonmeter for Cubes.	Rs.	15,000.00
11.	AT 208	Laboratory concrete mixer	Rs.	50,000.00
12.	AT 216/1	Cm 15x15x15 cube molds (Qty 9)	Rs.	3,000.00
13.	AT 221/1	ø 15x30 Cm cylinder mds (Qty 3)	Rs.	15,000.00
14.	AT 231/E	Electric Portable tip vibrator	Rs.	25,000.00
15.	AT 236	Thermostatic Tank (conforming to ASTLA C-31 specification).	Rs.	25,000.00
16.	AT 239/MH	Sragle phase accelerated curing tank with micro processor programme.	Rs.	50,000.00
17.	AT 206/S	Electric shaker with timer (220 V , 50 HZ)	Rs.	15,000.00
18.		Sieve at ASTH (Two sets)	Rs.	10,000.00
19.		Sieve set BS (Two sets)	Rs.	10,000.00
20.		Measurements (Mod B 115/1)		
		(Mod B 115/2) Geometers.	Rs.	5,000.00
21.		Blaince air permeability meter Mod C-1	Rs.	10,000.00
22.		Water fow slow device Mod C-3	Rs.	10,000.00
			Rs.	3,11,000.00

	B.F.	Rs.	3,11,000.00
23. Automatic Vicatapparatus Mod C-32		Rs.	20,000.00
24. Heat measurement of Hydration Mod C-42		Rs.	28,000.00
25. Flexural and tensile strength of cement and mortar Mod. C-90 Mod. C-90/1 Mod. C-90/2 Mod. C-90/3		Rs.	20,000.00
	Total	Rs.	3,79,000.00

c) EQUIPMENT FOR HIGHWAY ENGG: LABORATORY

S.No.	Item Description	Part No/O Set No.	Qty	Price in Rs.
1.	Sieve Analysis sand and aggregate.	SET 4203	4	40,000.00
2.	Clay Lumps in aggregate.	SET 4207	2	16,000.00
3.	Flakness & Eloggation.	SET 4210	2	20,000.00
4.	Relatic Density & absorption of aggregate.	SET 4215	2	20,000.00
5.	Specific Gravity & absorption of aggregate.	SET 4220	2	20,000.00
6.	Absolute specific gravity of filler.	SET 4222	1	10,000.00
7.	Bulk Density of aggregates.	SET 4226	1	10,000.00
8.	Voild content of aggregate.	EL 42-250	1	20,000.00
9.	Soundness of aggregates.	SET 4252/1	1	10,000.00
10.	Aggregate crushing value.	SET 4262	1	10,000.00
11.	Aggregate abrasion value.	SET 4272/1	1	10,000.00
12.	Stripping Test of Bituminous, aggregates.	SET 4511/1	1	10,000.00
13.	Extraction of Bitumen.	SET 4515/1	1	15,000.00
14.	Bulk specific gravity of Bitumenous Mixture.	SET 4520	1	15,000.00
15.	Theortical Maximum specific gravity.	SET 4521/1	1	20,000.00
16.	Marshall stability test.	SET 4225/1	1	16,000.00
17.	Flash point of asphalt.	SET 4620	1	20,000.00
18.	Softening point.	SET 4635/1	1	20,000.00
19.	Asphalt penetration test.	SET 4640/1	1	10,000.00
20.	Viscosity of Asphalt.	SET 4649/1	1	20,000.00
21.	Dail guage.	EL 20-150	12	12,000.00
22.	General purpose Oven 200 c	EL 22-102/1	2	20,000.00
	250 c	EL 22-133/1	2	20,000.00
	300 c(large size)	EL 22-138/2	2	20,000.00
			Rs.	4,04,000.00

				B.B.F. 4,04,000.00
25.	Hot plate 2000 W.	EL 22-310/1	2	10,000.00
26.	Metter Top loading.	EL 22-605/1	1	20,000.00
27.	Meter Top loading Balance.	EL 22-608/1	1	20,000.00
28.	Student Balance.	EL 22-700	4	20,000.00
29.	Field and laboratory scale.	EL 22-730	2	20,000.00
30.	" " " "	EL 22-745	2	20,000.00
31.	Conter Scale(with weight box)	EL 22-770	2	20,000.00
32.	Riffing box ASTM D 421	SET 2319	1	25,000.00
33.	Moisture content determination.	SET 2320	2	20,000.00
34.	Grain size analysis.	SET 2448/1	2	20,000.00
35.	Moisture density relation of soil.	SET 2840	2	15,000.00
36.	Proctor Mould.	EL 28-600	2	10,000.00
37.	Standard compaction Rammer.	EL 28-604	2	20,000.00
38.	Automatic compactor.	EL 28-629/1	2	10,000.00
39.	C.B.R. Test in laboratory.	SET 2910/1	2	30,000.00
40.	C.B.R. in field.	SET 2913	1	15,000.00
41.	Field Density Test.	SET 2926	1	10,000.00
42.	Sand cone: EL	EL 29-430	4	12,000.00
43.	Plastic container.	EL 29-432	4	16,000.00
44.	Density Plate.	EL 29-434	4	16,000.00
45.	Density Chisel.	EL 29-506	8	5,000.00
46.	Various structures experimental models for undergraduate students in fully functional forms.	Complete set of experimental models.		50,000.00
47.	Software MAP Programmes. Stres, strudle, P-France, V-Frame of other latest version of structural software with additional blank diskets.	Compatable with item computer.		55,000.00
		Total Rs.		8,63,000.00

d) EQUIPMENT FOR HYDRAULICS LABORATORY IN CIVIL ENGG: DEPTT:

S.NO.	Description of Apparatus	Qty	Cost
1.	Model Reservior and Surge Tower Apparatus.	1	Rs. 50,000.00
2.	Hydraulic Bench Experiments complete with all the accessories for P 6100.	4	Rs. 8,00,000.00
i)	Centrifugal pump characteristic.		
ii)	Flow in pipes and pipe fittings.		
iii)	Flow through orifices and over weirs.		
iv)	Flow in channels.		
v)	Fluid flow measurement.		
vi)	Bernoulli's experiments.		
vii)	Hydrustatics.		
viii)	Free and forced vortices.		
ix)	Hydraulic Machines.		
	Total		Rs. 8,50,000.00

EQUIPMENT FOR SURVEY LABORATORY.

1.	THIA the one second Micrometer with Tripod.	4	Rs. 4,00,000.00
2.	Automatic Precision Level B1/BIC with Tripod.	4	Rs. 3,00,000.00
	Total		Rs. 7,00,000.00

2. DEPARTMENT OF ELECTRICAL ENGINEERING.

(a) EQUIPMENT FOR ELECTRICAL ENGINEERING DEPARTMENT

(ELECTRONICS ENGINEERING)

		Qty	Unit Price	Total Cost
1.	Oscilloscopes.	20 Nos	Rs. 25,000/-	Rs. 5,00,000
2.	Power supplies.	30 Nos	Rs. 10,000/-	Rs. 3,00,000
3.	Meters.	80 "	Rs. 10,000/-	Rs. 8,00,000
4.	Experimental Units	40 "	Rs.1,00,000/-	Rs. 40,00,000
5.	Consumable.	04 "	Rs.1,00,000/-	Rs. 4,00,000
				Rs. 60,00,000

(b) EQUIPMENT FOR COMMUNICATION LABORATORY

S.No.	Items	Total Cost
1.	Experimental Kit for performing Basic and advanced experiments on T.V., such as modulation demodulation, synchronization colour carrer.	US $ 35,000.00
2.	Experimental Kit for Performing Basic and advanced experiments on Digital Communication and multiplexing techniques such as FDM, TDM, Pulsing etc.	US $ 15,000.00
3.	Experimental Kit for teaching Telephony and Optical Communications such as Exchanges, Switching, Digital Switching Optical fibers optical sensors and transmitters etc.	US $ 20,000.00
4.	Equipment Kit for teaching Microwave techniques such as wave guides, microwave sources, antenas transmission properties etc.	US $ 30,000.00
	Total	US $ 1,00,000.00

1 US $ = @ Rs. 17.80

US $ 1,00,000 x 17.80 = Rs. 17,80,000.00

(c) EQUIPMENT FOR POWER SYSTEM IN ELECTRICAL ENGINEERING DEPARTMENT.

Item		Qty	Cost per Unit	Estimated Cost
1)	Protection System Simulator consisting of:		Rs. 6,00,000.00	Rs. 6,00,000.00
a.	Directional earth fault relay.	1		
b.	Differential relay.	1		
c.	Inverse time over current relay.	1		
d.	Current time relay.	1		
e.	Over current relay.	1		
f.	Simulating panel with circuit breaker.	1		
g.	3 -Single phase transformer.	1		
h.	Digital trainer.	1		
i.	Static relay trainer.	1		
j.	Protective relay installation kit.	1		
k.	Relay test set.	1		
l.	Power pack.	1		
m.	Load resister.	1		
n.	Transformer single phase.	1		
o.	Ammeter 0-2 A	4		
p.	Ammeter 0-12 A	1		
q.	Rhiostate 150 Ohms	1		
r.	Rhiostate 500 Ohms	1		
s.	Current transformer.	6		
t.	Load Switch.	1		
u.	Line model.	2		
v.	Second meter.	1		
w.	Simulator pannel.	1		
x.	Multi Meter.	3		
y.	Volt meter.	1		

Rs. 6,00,000.00

3. DEPARTMENT OF MECHANICAL ENGG:

(a) EQUIPMENT FOR DEPARTMENT OF MECHANICAL ENGINEERING

AUTOMOBILE ENGINEERING

S.No.	Description of Equipment	Quantity		Cost
1.	THEPRA-Erehmomess:			
	Hydraulic dynamometer for OTTO and Diesel engines.	1	Rs.	1,50,000/-
	The compact setting up allows rapid change from one engine to another.			
2.	THEPRA-Air/Fuel Measuring.			
	An ideal instrument to measure air and fuel comsuiption on engine .. under test.	2	Rs.	45,000/-
3.	Measuring and checking of Wear in cylinder:			
	Wear can to measured at all positions of cylinder.	1	Rs.	25,000/-
4.	University Brake Test-Stand.			
	Brake-forces in drum and disc brakes, friction valves of brake-pads, effect of dry and wet braking.	1	Rs.	1,00,000/-
5.	Automotive Clutch Testingt			
	Contact force, transferable torque, dependable on the state of clutch parts (220 volts-50 cycles electric supply)	1	Rs.	1,00,000/-
6.	Diesel Injection Pump test stand:			
	Start of injection, end of injection, change and measurement of injection. Volume, injection. Volume, injection nozzle, (Cartrifugal governor).	1	Rs.	1,00,000/-
7.	Front Axle Measuring stand with Wishbone Suspensiont-			
	Adjustment and measuring of: Track, Comber, Castor, Kingpininclination, steering trapezoid and measurement of electric forces.	1	Rs.	79,000/-
			Rs.	5,95,000/-

		B.F.	Rs.	5,95,000/-

S.No.	Description of Equipment	Qty	Cost	
8.	Transparent Hydraulic Brakes:			
	Function of master cylinder, wheel brake cylinder, warning upto brake fluid, compensation chamber: trapped-air.	1	Rs.	52,500/-
9.	Test stand for electric systems:			
	Complete lighting equipment, ignitions systems, diesel preheating systems (with voltage regulator 6-12-16 V) and 30/70 A.	1	Rs.	50,000/-
10.	Test stand for the electric/electronic system			
	Diode testing (polarity), rectification through diode, alternateor, startor with battery, ignition distributor.	1	Rs.	1,00,000/-
11.	K-JETRONIC:			
	Mechanical-fuel injection, measurement of air volume, mixture governor, measrurement of injection volume, Warm-up governor.	1	Rs.	1,00,000/-
12.	Shock Absorber.			
	Plotting of diagrams of wheel and body vibrations, exchangeable shock absorbers	1	Rs.	80,000/-
13.	Diesel Injection Element.	4	Rs.	4,000/-
14.	Hydraulic unit Main brake cylinder with power booster attachment unit for Sr: No. 4 & 5.	1	Rs.	50,000/-
15.	Transistorized ignition coil system with HALL transmitter	1	Rs.	25,000/-
16.	Instruction Model Two stroke Engine, Model No. Best Nr. 4042.		Rs.	20,000/-
17.	Instruction Model Wankal Engine, Model No. Best Nr. 4045		Rs.	20,000/-
			Rs.	10,96,500/-

		B.F.	Rs.	10,96,500/-
S.No.	Description of Equipment	Qty.	Cost	
18.	Original Automatic Gear Box. Model No. Best Nr. 4440.		Rs.	20,000/-
19.	Instruction Model Automatic Transmission. Model No. Best Nr. 4024.		Rs.	30,000/-
20.	Instruction Model Turo Jet. Model No. Best Nr. 4715.		Rs.	20,000/-
21.	Air and Steam Nozzle Demonstration App. Fase 210 Model No. TD-203.		Rs.	30,000/-
22.	Gilkes-Rollab-GA-10 Supersonic-Wind-Tunnel (Complet - Set) (with 220 volts and 50 cycles).	1	Rs.	1,50,000/-
23.	Gilkes-GT 117 Turbojet-Engine Test-set (complete set) (with 220 volts and 50 cycles)	1	Rs.	2,00,000/-
		Total	Rs.	15,46,500/-

(b) EQUIPMENT FOR HEAT TRANSFER LAB: IN MECHANICAL ENGG: DEPARTMENT.

Sr. No.	Description Equipment	Qty	Total Cost in Rs.
1.	THERMO-FLUID TUTOR GILKES-GT-106 (complete unit with 220 volts and 50 cycles electric supply).	1	1,00,000.00
2.	Flow Visualisation Wind-Tunnel GILKES GA-9.	1	20,000.00
3.	Two-shaft Gas Turbine GILKES GT 82-2 (with 220 volts supply).	1	60,000.00
4.	"Combustion Laboratory Unit" C 491.	1	50,000.00
5.	"Electronic, fire, analytical balance" "Digital-Display."	3	80,000.00
6.	Tool-maker's Digital Measuring Micro-scope WMM 100/50.	1	50,000.00
7.	Universal Tensile Testing machine for Tensile, copression and bending etc: 30 ton capacity (with 220 volt and 50 cycles).	1	2,50,000.00
8.	Open-front Power PRESS" (small size) with puch and Dies of all kinds) (220 volts and 50 cycles).	1	1,00,000.00
9.	Fluididiation and Fluid V Bed Heat-transfer-unit. Cat No. 692 (Edition II P.A. Hilton Ltd). England.	1	87,500.00
10.	Heat conduction unit Cat. No. 940.	1	17,500.00
11.	Boiling Heat Transfer unit Cat No. 653.	1	35,000.00
12.	Water/Water Turbulent-Flow Heat Transfer Unit Cat No. 950.	1	52,500.00
13.	Unit Cat No. 910.	1	52,500.00
14.	Thermal Radiation Unit. Cat No. 960.	1	35,000.00
15.	Temperature Measurement Unit.	1	17,500.00
16.	Conductive Heat Transfer Experimental and Research Unit.	1	1,75,000.00
17.	Mechanical Engg: Water cooling Tower.	1	52,500.00
18.	Instruction Model two Stroke Engine, Model No. Best No. 4042 W.Germany.	1	7,000.00
19.	Inst: Model Epicylic gear Model No. Best Nr. 4029, W.Germany.	1	12,000.00
		Total Rs.	12,54,000.00

(c) PRODUCTION ENGINEERING

S.No.	Description of Equipment	Qty.		Cost
1.	Sigma Mechanical Comparator	1	Rs.	25,000/-
2.	Talymin Electrical Comparator	1	Rs.	25,000/-
3.	Horizontal Optical Computor.	1	Rs.	25,000/-
4.	Micropticc Auto-Collimator.	1	Rs.	50,000/-
5.	Flatness Interferometer.	1	Rs.	50,000/-
6.	Set of Slip-guages.	1	Rs.	15,000/-
7.	Set of Plug and ring gauges.	1	Rs.	15,000/-
8.	Profile-Projector	1	Rs.	35,000/-
9.	Laser, Centre detector, and readout meters.	1	Rs.	30,000/-
10.	PNUMATIC-Comparator	1	Rs.	25,000/-
11.	Talysurf Instrument.	1	Rs.	30,000/-
12.	Laser-Beam Machining.	1	Rs.	1,60,000/-
		Total	Rs.	4,85,000/-

(d) FUEL-LABORATORY/METALLURGY LABORATORY

S.No.	Description of Equipment	Qty	Cost	
1.	Micro-Hardness Tester O.S.K. 2278 2nd Edition.	1	Rs.	30,000/-
2.	Automatic Densimeter O.S.K. 1894 2nd Edition	1	Rs.	30,000/-
3.	Saybolt-Viscometer, O.S.K. 2872	1	Rs.	20,000/-
4.	Gas-Calorimeter, O.S.K. 2911 (complete set).	1	Rs.	25,000/-
5.	Bomb-Calorimeter O.S.K. 2912 (complete set) with 220 volt & 50 cycles Elect. supply).	1	Rs.	30,000/-
6.	Oxygen-Bomb-Calorimeter (Digital type) O.S.K: 2914 (complete set)	1	Rs.	30,000/-
7.	Cone-Penetration for Greases O.S.K.2951	1	Rs.	15,000/-
8.	Metallographic-Microscope, O.S.K.5900 (MR) (with 220 volts & 50 cycles electric supply).	1	Rs.	55,000/-
9.	Metallographic Microscope, O.S.K. 5898 (220 volts and 50 cycles)	1	Rs.	55,000/-
10.	Optical- Pyrometer, O.S.K. 4829	1	Rs.	30,000/-
11.	Digital Thermo-meter, O.S. K.4827	2	Rs.	10,000/-
12.	Digital strobo scope, O.S.K. 4794 (with 220 volts and 50 cycles)	2	Rs.	10,000/-
13.	Precision - Balance O.S.K. 4725	2	Rs.	30,000/-
14.	Specimen mount press Model 5909 with accessories	1	Rs.	30,000/-
15.	High speed precision cut off Machine Model O.S.K. 5908, with accessories	1	Rs.	30,000/-
16.	Specimen Dryer Model O.S.K. 5913 with accessories.	1	Rs.	15,000/-
17.	Hardness tester Model 436881 "Frankoskop" for brinell Vickers and Rockwell Hardness test equiped with projection device.	1	Rs.	2.00.000/-
	Total		Rs.	6,45,000.00

(o) GEOMETRICAL DRAWING MODELS

Product Number	G.Cussions Ltd: 102 Great Clowes Street Manchester M 7-9 RH England Description	Product Group	UET REF	Price F.O.B. in £
P-1002	Simple Bearing Housing (37mm)	23	G-2	106
P-1003	Split Bearing with separate Shells.	23	G-2	127
P-1005	Assembly Key & Slotted Keyway.	23	G-2	189
P-1006	Assembly with Saddle Key.	23	G-2	81
P-1008	Taper Pin to allow rotation.	23	G-2	95
P-1012	Foundation Bolt.	23	G-2	81
P-1014	Gib and Cotter Joint in Section.	23	G-2	120
P-1017	Piston with Rings and Part Piston Rod and Nut.	23	G-2	145
P-1025	Single Rivetted Lap Joint.	2	G-2	59
P-1026	Double Rivetted Lab Joint.	23	G-2	72
P-1027	Angle Iron Joint.	23	G-2	72
P-1029	Wall Bracket (for P-1003).	23	G-2	143
P-1030	Ragbolt (25mm) with Nuts.	23	G-2	127
P-1032	Knuckle Joint.	23	G-2	170
P-1033	Rivetted Joint with 6 Rivet Forms.	23	G-2	143
P-1034	Thread Form Isometric.	23	G-2	72
P-1035	Thread Form Buttress	23	G-2	72
P-1036	Thread Form Square	23	G-2	72
P-1037	Bolt, Nut and Washer.	23	G-2	72
P-1040	Pulley	23	G-2	127
P-1043	Connecting Rod End with Gibs and Cotter.	23	G-2	170
P-1045	Double Rivetted Butt Joint.	23	G-2	85
P-1046	Belt Pulley Grooved.	23	G-2	143
P-1051	Big End Assembly.	23	G-2	262
P-1066	Bearing Shells with Location.	23	G-2	120
P-1073	Box Spanner.	23	G-2	72
P-1113	Complete Set of 22 mm Models in a Box.	23	G-1	2606
P-1138	Set of models P-1121 to P-1137 inclusive.	23	G-1	1723
			O.Total: £	7324

@ 1 £ = Rs. 33.30

£ 7324.00 x 33.30 =

Rs. 2,43,889.00

4. EQUIPMENT FOR AGRICULTURAL ENGINEERING DEPARTMENT

(a) AGRICULTURAL MACHINERY AND POWER TESTING LABORATORY.

S.No.	Items	Quantity	Total Cost in Rs.
1.	Implement testing bed with Automatic Motorised crane on Girdrus for Tillage equipment.	One	90,000.00
2.	Milling Machine.	One	2,00,000.00
3.	Heavy Duty Lathe Machine.	One	24,000.00
4. a.	Suzuki Engine of 3.5 H.P.(Six in Numbers) Single Cylinder, Two Stroke.	One	80,000.00
b.	Dongfin 15-20 H.P. (Three in Numbers) Two Cylinder, Two or Four Stroke.		
5.	Shearing Machine.	One	1,00,000.00
6.	Press Brake or Bending Machine.	One	1,50,000.00
7.	Rolling Machine.	One	1,00,000.00
8.	Photostate Machine with all accessories.	One	1,00,000.00
9.	Camera.	One	8,000.00
10	Slide Projector.	One	10,000.00
		Rs.	8,62,000.00

			US Dollar
11.	Demonstration Model Carbureter.	One	500.00
12.	Carburettor Experimental and Demonstration Device for pressure and flow Experiments.	One	600.00
13.	Demonstration Panel K-Jetronic.	One	400.00
14.	Training Stand Motoronic System.	One	400.00
15.	Demonstration Model Lambda Probe (exhaust Pipe).	One	400.00
16.	Instruction Model Diesel Engine.	One	500.00
17.	Instruction Model Original Diesel Engine.	One	500.00
18.	Cylinder Head Pre Chamber.	One	200.00
19.	" " Direct Injection.	One	200.00
20.	" " Whirl Chamber.	One	200.00
21.	Vaccume Regulator.	One	200.00
22.	Nozzle Holder with Injection.	One	300.00
23.	" " " Pintle Nozzle.	One	200.00
		$	4,500

		B.B.F.	$	4600.00
Sr. No.	Items	Qty		US Dollar
24.	Injection Timing Gear.	One		250.00
25.	Diesel Engine piston pump for direct Injection.	One		350.00
26.	Plunger and Barrel assembly.	One		300.00
27.	Fuel supply pump/diesel	One		200.00
28.	Instruction model Wankel Engine.	One		200.00
29.	Instruction model four stroke petrl engine.	One		300.00
30.	Lubrication Pump.	One		200.00
31.	" Colling	One		200.00
32.	Training stand K-Jetronic	One		200.00
33.	Instruction model diesel Pump.	One		300.00
34.	" " " Injection.	One		200.00
35.	Diesel In-line pump with fly weight Governor	One		200.00
36.	Wall model of diesel Injection system.	One		1000.00
37.	Diesel In-line Pump with fly weight Pneumatic Governor	One		600.00
38.	Instruction model Diesel Injection Pump distributor			570.00
39.	Instruction model distributor fuel injection Pump.	One		800.00
40.	Instruction model distributor fuel injection pump type boasch	One		900.00
41.	Diaphragm spring clutch.	One		500.00
42.	Distributor Injection Pump Roasum-Master	One		900.00
43.	Double Disc clutch	One		500.00
44.	Instruction model clutch coupling	One		400.00
45.	Torque Converter.	One		400.00
46.	Hydraulic clutch	One		300.00
47.	Instruction model Gear box with clutch (Large model)	One		500.00
48.	Instruction model original syncronised gearing with clutch.	One		600.00
49.	Instruction model Epicyclic gear	One		300.00
50.	Instruction model automatic transmission with torque Converter.	One		500.00
			$	16270.00

		B.R.F.	16[illegible]0.00
Sr. No.	Items	Qty	US Doll.
51.	Instruction Model Original Servo Steering Gear (Sectioned made of Original Parts).	One	400.00
52.	Instruction Model Original Steering gear with front axle.	One	500.00
53.	Worm and wheel steering gear(sectioned model made of original parts an metal perestal)	One	600.00
54.	Instruction model original servo brake (sectioned model made of original parts)	One	400.00
55.	Instruction model Disc brake.	One	500.00
56.	Instruction model Hydraulic brake.	One	600.00
57.	Instruction model Hydraulic Dual circuit brake (standard model)	One	500.00
58.	Data Logger.	One	1,000.00
59.	Crow wheel and pinion demonstration with teaching notes.	One	500.00
60.	Dual drum brake system.	One	500.00
61.	Diesel fuel system and turbocharger.	One	800.00
62.	Petrol fuel system.	One	500.00
63.	Ignition system.	One	300.00
64.	Automatice electrical system.	One	300.00
65.	Electric Motors and Instrumention.	One	1,000.00
66.	Suspension and cooling system.	One	1,000.00
67.	Gear Box.	One	800.00
68.	Rear Axle and Hydraulic Brake.	One	600.00
69.	Tractor electrical system.	One	600.00

C/O

Sr: No.	Items	Qty.	US Dollars.
70.	Pump (Fuel)	One	1,200.00
71.	Farm Tractor Crawler type.	One	6,000.00
72.	Strain Gauge Kit.	One	1,000.00
73.	Whirling of Shafts.	One	500.00
74.	Motor Scope (Oscilloscope Engine Analysis).	One	5,000.00
75.	Auto Mate (Computer Engine Analyser).	One	5,000.00
76.	OSC, Uoscope.	One	800.00
77.	SEHI Automatic Seamer for round cans.	One	1,500.00
78.	Automatic Filer.	One	2,000.00
79.	Original Steering Gear.	One	300.00
80.	Instruction Model Ball Steering (Sectioned Model made of Original parts an metal perestal).	One	400.00
81.	Multi Tester.	One	800.00
82.	Four speed Mannual syncromesh gear box with teaching notes.	One	500.00
83.	Three speed automatic gear box with teaching notes.	One	500.00
84.	Rearaxle unit complete with teaching box.	One	900.00
85.	Set of three steering boxes with teaching notes.	One	700.00
		Total US $	54,684.00
		1 US $ @ Rs.17.80 Total	Rs.9,73,375.00

(b) EQUIPMENT FOR AGRICULTURAL ENGINEERING DEPARTMENT

S.No.	Name of Equipments	Quantity	Cost in Rs.
1.	Soil Water Tensiometers.	5	10,000.00
2.	Pressure Membrane Apparatus.	5	10,000.00
3.	Soil Drying Oven.	2	24,000.00
4.	Chemicals for Soil Testing.	-	40,000.00
5.	Constant Head Permeameter.	2	20,000.00
6.	Falling Head Permeameter.	2	30,000.00
7.	Gravimetric Mixture Meters.	5	80,000.00
8.	Infiltrometers.	5	75,000.00
9.	Portable digital PH Meters.	5	2,00,000.00
10.	Combination Test kit for Soils.	5	70,000.00
11.	Water quality testing Kit.	2	24,000.00
12.	Sprinkler Irrigation Model.	2	1,00,000.00
13.	Drip Irrigation Model.	2	1,40,000.00
14.	Neutron Scattering Apparatus.	2	70,000.00
15.	Thermocouples.	2	50,000.00
16.	Thermal Balances for Moisture Measurement.	5	1,00,000.00
17.	Meteorological Equipments for Field and Laboratory.	2	2,00,000.00
18.	Sieve Analysis Set.	5	50,000.00
19.	Portable Soil Thermometers.	5	40,000.00
20.	Soil Anger Set.	5	50,000.00
21.	NPK Soil Testing Kit.	2	40,000.00
22.	Salinity meters.	5	75,000.00
23.	Electrical Conductivity Probe Kit.	2	20,000.00
24.	Water Level Indicator.	5	1,00,000.00
25.	Liquid Limit Device.	5	80,000.00
26.	Sieve Shaker (Electrical).	2	80,000.00
27.	Analytical Balances.	5	1,60,000.00
28.	Electronic Top-Pan Balance.	2	1,60,000.00
		Total Rs.	25,98,000.00

(5). EQUIPMENT FOR MINING ENGINEERING DEPARTMENT.

(a). (SAFETY AND MINE VENTILATION LAB:)

S.No.	Items	Qty.	Total Cost
1.	Pipe flow and Nozzle apparatus and fan test rig with a set of additional fittings like 900 Bend, right angle elbow, Cascaded corners, radial and backward curved impellors, orifice plates and floor stands etc.	One	£ 4,000.00
2.	Fan Test Set Complete with spring blance, revolution counter etc,	One	£ 3,000.00
3.	Multitube Manometer complete with polythere tubing etc: Size No. 1.	One	£ 650.00
4.	Two stage Centrifugal Pump Test Set.	One	£
5.	Pipe Friction (Tec Quipment Bosall street, Long Eaton, Nothingham NG 10 2AN England).	One	£ 600.00
6.	Losses in Pipe Bends --do--	One	£ 2,000.00
7.	Portable Test Set. (Airflow Developments Ltd: Lancaster Road High Wycombe Bucks England).	One	£ 200.00
		Total	£ 10,450.00
8.	Self Contained Oxygen Breating apparatus (BG 174 Dragerwerk Ag Libeck).	One	Rs. 5,000.00
9.	Universal Test Set RZ 25.	One	Rs. 2,000.00
			Rs. 7,000.00

1 £ = @ Rs. 33.30 x 10,450.00 = 3,47,985.00

Rs. 7,000.00

G. Total Rs. 3,54,985.00

(b) EQUIPMENT FOR MINE VENTILATION AND SAFETY LABS:

S.No.	(i) Equipment (Mine Ventilation)	Qty	Price in Rs.
1.	Sets of connecting ducts.		20,000.00
2.	Getger counter.	1 "	20,000.00
3.	Portable dust sampler.	1 "	10,000.00
4.	Radon detector.	1 "	20,000.00
5.	Digital Luciometer.	1 "	10,000.00
6.	Wind Tunnel, complete with a small fan.	1 "	1,00,000.00
		Total	Rs. 1,80, 000.00

(ii) EQUIPMENT (MINE SAFETY)

S.No.	Description	Unit/Price	Qty	Price in Rs.
1.	Portable O_2 meter for O_2 measurement in mines.	20,000/-	2	40,000.00
2.	Portable Co Detector for Co measurement in mines.	35,000/-	2	70,000.00
3.	Portable Co_2 Dececter for Co_2 measurement in mines.	35,000/-	2	70,000.00
4.	Portable methanometer for measurement of methane in mines.	40,000/-	2	80,000.00
5.	Multi gas detector for measurement different gases in mines.	40,000/-	2	80,000.00
6.	Portable dust sampler for dust sampling in mines.	10,000/-	2	20,000.00
7.	Digital luxiometer for measuring the low intensities of illumination in mines.	10,000/-	2	20,000.00
8.	02 Breathing apparatus for rescuing mines workers after an explosion.	20,000/-	1	20,000.00
9.	Self Rescuer for use by mine workers in emergency in coal mines.	15,000/-	4	60,000.00
10.	Oil Flame Safety lamps.	1,250/-	4	5,000.00
11.	Miners safety lamps attachable to hard hats.	250/-	10	2,500.00
12.	Miners safety hard hats (plastic made.	300/-	10	3,000.00
13.	Wet and Dry bulb Hygrometer.	1,500/-	2	3,000.00
14.	Portable Aneroid barometer.	200/-	2	4,000.00
			Total	Rs. 4,77,500.00

(c) EQUIPMENT FOR MINERAL DRESSING LABORATORY.

S.No.	Description	Price in Pak: Rs.
1.	X.R.F. (X-Ray Flourescence Equipment).	70,00,000.00
2.	U.V. Spectro Photometer (trace elements).	3,00,000.00
3.	Deionised water production apparatus.	20,000.00
4.	Compressor (small).	30,000.00
5.	Filter drum (Pressure).	40,000.00
6.	Balance (1) (readability .01 gram).	25,000.00
7.	Balance (2) (readability .001 gram).	48,000.00
8.	Ball mill (continuous) + classifier.	1,20,000.00
9.	Magnetic stirrer.	5,000.00
10.	P.H. Meter.	18,000.00
11.	Electro static separator.	1,25,000.00
12.	High intensity Magnetic separator.	2,70,000.00
13.	Zeta potential measuring equipment	40,000.00
14.	High speed blander	15,000.00
15.	Crusher (gyratory)	80,000.00
16.	Rolls crusher	38,000.00
17.	Ultra sonic bath	34,000.00
18.	Vibrating grinding Mill	1,48,000.00
19.	S-prials	1,50,000.00
20.	Wet sieve analysis equipment	45,000.00
21.	Two sets of sieves, (ASTM), (BS)	28,000.00
22.	Automatic pointer scale capacity 5 Kg	23,000.00
23.	Automatic capacity 15 Kg	13,000.00
24.	Thermostatic Water bith	67,000.00
25.	Laboratory Furnace	60,000.00
26.	Water Distillation Apparatus	10,000.00
27.	Sedimentation apparatus	1,00,000.00
28.	Mercury Pycnometer	25,000.00
29.	Refracto. meter	45,000.00
30	Flotation reagents (various)	25,000.00
31.	Flotation cell (Automatic)	1,00,000.00
	Total Rs.	90,47,000.00

(d) EQUIPMENT FOR DRILLING LABORATORY.

S.No.	Instrument Discription	Qty	Cost in Rs.
1.	Single tube Core barrel.	1	50,000.00
2.	Double tube rigid type core barrel.	1	60,000.00
3.	Double tube swivel type core barrel.	1	80,000.00
4.	Wire line core barrel.	1	50,000.00
5.	Marsh funnel for measurement of Viscosity.	1	20,000.00
6.	P.H. Meter.	1	10,000.00
7.	Clinometer.	1	15,000.00
8.	Mass compass for surveying shallow holes.	1	5,000.00
9.	Mass compass for surveying deep holes.	1	7,000.00
10.	Tropari drill hole instrument.	1	15,000.00
11.	Multi shot directional survey instrument.	1	50,000.00
		Total Rs.	3,62,000.00

(e) EQUIPMENT FOR ROCK MECHANICS LAB:

1.	Universal Testing Machine (100 Tons capacity) with Data aquisition system complete with monitor and printer.	1	25,00,000.00
2.	Strain gauges and meters.	1	2,00,000.00
3.	Schmidt's Hammers or the like.	2	20,000.00
4.	Direct shear test apparatus (shear box).	1	2,50,000.00
5.	Rock sample grinder & polisher.	1	75,000.00
6.	Digital weighing scale 5/10 Kg capacity.	2	50,000.00
7.	Seismograph (for measurment of blast vibrations.	1	25,000.00
8.	Vernier callipers with dials.	2	2,000.00
9.	Word Processer for reports, Projects, Office work.	2	50,000.00
10.	Hollow Drill barrells with fixed bits in various sizes, 1" to 3".	12	70,000.00
11.	Core Drilling Machine with Bit.. of various sizes.	1	2,00,000.00
12.	Rock cutting saw with diamond impregrated Blades.	1	1,00,000.00
		Total Rs.	35,42,000.00

(f) EQUIPMENT FOR SURVEY LABORATORY

S.No.	Name of Equipment	Qty	Cost in Rs.
1.	Automatic routine level with horizontal o circle 360/400 g.	1	1,00,000.00
2.	Dumpy level with tolting screw telescopic magnefication 30 x	1	52,000.00
3.	Automatic engineers level reading to 1", horizontal circle 360° with erect telescope image.	1	60,000.00
4.	Mining suspension theodalete with high resolution telescope with reading microscope.	1	1,22,000.00
5.	Set of essential accessories with item No.4.	1	9,000.00
6.	Special temperature measuring device battary operated range (55° to 155 C°, with spare batteries.	1	6,000.00
7.	Techometric staff telescopic made of aluminum tubing.	4	6,000.00
8.	Leveling staff 50 mm wide length 3 m made of wood,	4	6,000.00
9.	Measuring tape staniless steel in metal frame in metric graduations on one sides and feet on other side length 330 ft.	3	9,000.00
10.	Distance meter, for measuring upto 10,000 meters highest accurany.	1	4,000.00
11.	Geological standar compass with dinometer gradation from (90°- θ -90°) with leather case.	1	11,000.00
12.	Geological stratum compass with declination are and leather case.	1	13,000.00
13.	Mining compass.	1	14,000.00
14.	Pracision pocket altimeter temp. compansated with leather case, with strap and separate whirling thermonmeter.	1	11,000.00
15.	LASER CONTROLLED THEODOLITE for high precision tunnel surveying with necessary accessions.	1	4,00,000.00
16.	Plane table techometer with auto reduction device, vertical circle reading to estimation to 1 with four interchenglable plotting rulers, plane table plate (420 x 420)mm.	1	60,000.00
			Rs. 8,83,000.00

		B.B.F.	Rs.	8,83,000.00
17.	Binoculars highest megnefications.	4	Rs.	50,000.00
18.	Tension handle (spring balance).	4	Rs.	2,000.00
19.	Substance bar (for linear measurement).	2	Rs.	4,000.00
20.	Thermometer for base line measurement.	8	Rs.	2,000.00
		Total	Rs.	9,51,000.00

EQUIPMENT FOR DIFFERENT LABORATORY.

(g) TEACHING AIDS.

S.No.	Description of equipment	Qty		Cost
1.	Slide Projectors.	4	Rs.	20,000.00
2.	Overhead Projectors.	4	Rs.	60,000.00
3.	Transparency Maker.	1	Rs.	5,000.00
4.	Projection type video cassettee recorder.	1	Rs.	35,000.00
5.	Folding Screens.	4	Rs.	20,000.00
6.	Pointer lights.	2	Rs.	2,000.00
7.	Carrasole for slide Projectors.	8	Rs.	2,000.00
		Total	Rs.	1,44,000.00

) GEOLOGY LAB:

1.	Collection of 30 rock forming minerals thin sections, corresponding to minerals.	Rs.	7,000.00
2.	Pocket scale of hardness points.	Rs.	11,000.00
3.	Set of 15 glass crystall models.	Rs.	11,000.00
4.	History of the Earth.	Rs.	6,000.00
5.	Mountains models.	Rs.	5,000.00
6.	Set of 28 Gem Stones.	Rs.	7,000.00
7.	Pulished or sections set of 80 mineral sections, arranged to different metallic elements.	Rs.	20,000.00
8.	Crystal and Atomic structure models. A set of six models to illustrate. Isometric, Tetragonal, Hexagonal, Orthorhambic and triclinic crystal system. (2 Nos).	Rs.	20,000.00
9.	Wooden Crystal Models. (2 Nos).	Rs.	5,000.00
10.	Micro-scope with Projection screen.	Rs.	9,00,000.00
		Total Rs.	9,92,000.00

(6). EQUIPMENTS FOR BASIC SCIENCE DEPARTMENT.

(a) PHYSICS LABORATORY

S.No	Items	Quantity	Total Estimated Cost
1.	Microwave Transmitter & Receiver Multimeter, Reflecting Plates and with all other access--ories.(Complete Set).	1 Set	Rs. 45,000
2.	Geiger Muller Counter, with GS Tube Source Kit (Co 60), (Complete Set).	1 Set	Rs. 1,00,000
3.	Electric Balance Single Fan.	1 No	Rs. 40,000
4.	V.T.V.M.	3 Nos	Rs. 45,000
5.	Power Supply (0-250V).	2 Nos	Rs. 30,000
6.	H.T.Power Supply (- 5 KV).	1 No	Rs. 20,000
7.	Auto Varia Travormer.	3 Nos	Rs. 8,000
			Total Rs. 2,88,000

Appendix 2. List of Equipment required for the proposed department of Chemcial Engineering.

a) General Chemcistry Laboratory:-

S.No.	Name of Apparatus	No.	Estimated Cost
1	Drying Oven	3	Rs. 10,000/-
2.	Thermostat	1	Rs. 30,000/-
3.	Hot Plate	1	Rs. 5,000/-
4.	Glassware Drier	3	Rs. 20,000/-
5.	Water bath	3	Rs. 20,000/-
6.	Heating Mantle	5	Rs. 15,000/-
7.	Chamber Furnance	1	Rs. 50,000/-
8.	Magnetic Stirrer	5	Rs. 10,000/-
9.	Rotary Vacum Evaporator	2	Rs. 15,000/-
10.	Flask Shaker	2	Rs. 50,000/-
11.	Calorimeter	1	Rs. 30,000/-
12.	Vacum Pump	2	Rs. 12,000/-
13.	Balance (Rough)	1	Rs. 8,000/-
14.	Flowmeter	2	Rs. 10,000/-
15.	Refrigerator	2	Rs. 16,000/-
16.	Laboratory Centrifuge	2	Rs. 40,000/-
		Total:-	Rs. 3,11,000/-
	Glassware & Chemicals		Rs. 1,00,000/-
		Total:-	Rs. 4,11,000/-

c) Analytical Chemistry Laboratory:-

S. No.	Name of Apparatus	No.	Estimated Cost
1.	Automic Absorption Spectrophotometer	1	Rs. 3,00,000/-
2.	UV Spectrophotometer	1	Rs. 1,25,000/-
3.	Polarograph	1	Rs. 3,50,000/-
4.	Electrolysis Apparatus	1	Rs. 50,000/-
5.	Gas Analysis Apparatus	1	Rs. 20,000/-
6.	Conductivitymeter	1	Rs. 2,000/-
7.	PH Meter	2	Rs. 15,000/-
		Total:-	Rs. 8,62,000/-

d) Special Laboratory:-

S. No/	Name of Apparatus	No.	Estimated Cost
1.	Automatic Flash point Tester	1	Rs. 40,000/-
2.	Redwood Viscometer	1	Rs. 6,000/-
3.	Distillation apparatus for Fuels	1	Rs. 2,00,000/-
4.	Tar Viscometer	1	Rs. 5,000/-
5.	Carbon Rsidue Tester	1	Rs. 3,000/-
6.	Vapour Pressure Tester	1	Rs. 10,000/-
7.	Cement setting time tester	1	Rs. 4,000/-
8.	Refractometer	1	Rs. 50,000/-
9.	Polarimeter	1	Rs. 2,00,000/-
10.	Apparatus for determining setting time of the cement	1	Rs. 25,000/-
		Total:-	Rs. 5,43,000/-

c) Unit Operation and Pilot Plant Laboratories:-

S. No.	Name of Equipment	No.	Estimated Cost
1.	Filter Press	1	Rs. 1,20,000/-
2.	Distillation Column	1	Rs. 5,00,000/-
3.	Wet and Dry Grinding Pilot Plan	1	Rs. 2,50,000/-
4.	Pilot Plant Shking Machine	1	Rs. 50,000/-
5.	Floatation apparatus	1	Rs. 3,00,000/-
6.	Grystalizer	1	Rs. 3,00,000/-
7.	Jaw Grusher	1	Rs. 2,00,000/-
8.	Majnetic Sparator	1	Rs. 2,50,000/-
9.	Spray Drier	1	Rs. 70,000/-
10.	Misc:	1	Rs. 1,00,000/-
		Total:-	Rs. 21,40,000/-

(7). EQUIPMENT FOR UNIVERSITY WORKSHOP

1. Horizontal Broaching Machine, Model RW 1000/2

a) BROACHING TOOLS :-

1. Pc.	Broach No. 4 Slot Depth 1,8+0,1 mm Slot Width 4 mm Broaching Length 12-30 mm total tool length 600 mm	DM	600.00
1.Pc.	Broach No. 13 Slot Depth 2,8+0,1 mm Slot Width 6 mm Broaching Length 20-60 mm Total tool Length 1000 mm	DM	750.00
1.Pc.	Broach No. 17 Slot depth 3,3+0,2 mm Slot width 8 mm Broaching Length 24-60 mm Total tool Length 1000 mm	DM	800.00

b) BROACH GUIDING ARBORS :

1 No. Arbor	Diam. 12 g^6 x 5 (4) x 90 mm long for slot width 4 mm	DM	400.00
1 No. Arbor	Diam. 20 g^6 x 6 x 130 mm long for slot width 6 mm	DM	400.00
1 No. Arbor	Diam. 25 g^6 x 8 x 130 mm long for slot width 8 mm	DM	450.00

2. CENTRIFUGAL CASTING MACHINE MODEL-A.

Accessories required :-

a)	Timer for preselecting centrifugal time.	DM	500.00
b)	Vulcanising Form 230 Ø	DM	800.00
c)	Gum Plates 230 Ø - 9 inch = 1 Set.	DM	60.00
	Total	DM	4,760.00

1 DM at the rate of = Rs. 10.80

Total in Pak Rs. 51,408.00

(8). EQUIPMENT FOR RESEARCH

(a). DEPARTMENT OF CIVIL ENGINEERING

Name of Project :- a) Model analysis of an integrated thin section Wall/roof structural system.

b) Development of Structural sandwich type integral structural system for lower cost housing.

c) Exploring this possibility of fiber reinforced concrete alone or in conjunction with M.S. reinforcement/ ferrocement for developing a low cost structural system for houses.

Sr: No.	Specification/Description	Quantity required	Total cost in Rupees
1.	Tensile Test accessory For Unitester universal testing machine cat No.C-21 complete with assorated gripping jaws for tensile testing of wire/thin dia rods/flats.	One complete set of tensile Test accessory	Rs. 5,000.00
2.	With Double Portal Fram Model LFDBIx2 complete structural lab: testing system with two actuators Model EPZ(S-15)nominal static load 1000 KN nominal dynamic load (500 KN) with piston stroke 250 mm. System must be completed in all respects to test specimen static as well as dynamic loads, complete with concrete strong floor. All accessories, inserts, complete with control systems for application & recording of static as well as dynamic loads. Fully operitional.		Rs.18,50,000.00
3.	DEMEC Strain gauges WF 52919, 50 mm length with ref rod setting bar and case.	One	Rs. 2,500.00
	WF 52920 -do- 100mm length	One	Rs. 2,500.00
	WF 52921 -do- 150mm length	One	Rs. 3,000.00
	WF 52930 -do- 200mm length	One	Rs. 3,000.00

CIVIL ENGINEERING DEPARTMENT

Sr: No.	Specification/Description	Quantity required		Total Cost Rs.
	WF 52932 -do- 250mm length	One	Rs.	3,000.00
	WF 52935 Stainless steel locating dises Box of 100	4 Boxes	Rs.	2,000.00
4.	Sieve Set 1482 (BS812 standard)	One	Rs.	5,000.00
	Sieve Set 1483 (BS 812 standard)	One	Rs.	5,000.00
	Sieve Set 1485 (ASTAM Standard)	One	Rs.	5,000.00
5.	WF 62020 Sieve shaker	One	Rs.	10,000.00
6.	Laboratory concrete mixer with drum WF 61200	One	Rs.	25,000.00
7.	Load test program controller 158 with cycle timer 158. 1 for use with MP 146 and 200 KN Jack 186.20	One	Rs.	25,000.00
8.	Interfaces and accessories for logging data from load cells straingauges, and livear displacement stransducors DT-50-A etc: For Digital measuring system UCAM-5BT		Rs.	10,000.00
9.	Portable strain Indicator P-3500 200 Volts Ac 50 HZ	One	Rs.	15,000,00
10.	Ten channel switch and balance unit SB-IK for use with P-3500	One	Rs.	8,000.00
11.	Electrical Resistance Strain gauges type EA-06-500 BH-120	10 Pkts	Rs.	6,500.00
	Type EA-06-250 BG-120	20 Pkts	Rs.	7,000.00
	Type Ea-06-125 AD-120	10 Pkts	Rs.	3,800.00
12.	Gauge Installation Kit MAK-1 complete with all items.	One	Rs.	2,000.00
13.	Gauge Installation test model 1300	One	Rs.	2,000.00
14.	Theodolites, Model TM-6	8	Rs.	5,60,000.00
		Total	Rs.	25,60,300.00

(b) ELECTRICAL ENGINEERING DEPARTMENT

Name of Project:- To study various signal processing methods.

Sr: No.	Specification/Discription	Quantity required	Total Cost Rs.
1.	Audio Analyser W.G. Model NFA-1	1	Rs. 5,000.00
2.	Universal Network and Filter W.G. Model UN-1	1	Rs. 6,000.00
3.	Noise Generater W.G. Model SNA-1	1	Rs. 6,000.00
4.	Spectrum and Network Analyser W.G. Model SAN-1	1	Rs. 10,000.00
5.	100 MHZ Oscilloscepe Philips Model PM 3267	1	Rs. 20,000.00
6.	Probes for Item 5 PM 8922	4	Rs. 1,000.00
7.	RCL Bridge Philips Model PM 6303	1	Rs. 10,000.00
8.	Service Manual of Item 7	1	Rs. 500.00
9. a)	TERCO Equipment for Studying Singals T 10	1	Rs. 1,00,000.00
	b) TERCO Equipment for Studying Microwave, system T 20	Total	Rs. 1,58,500.00
	c) TERCO Equipment for Studying Telephone system T 30		

(c) DEPARTMENT OF MECHANICAL ENGINEERING

Name of Project:- Design and Construction of adiabetic water cooler with dehumidifier.

Sr: No.	Specification/Description	Quantity required		Total Cost Rs.
1.	THT-730-P Dial Thermometer	Nos. 2	Rs.	1,584.00
2.	THT-650-030A Dial Thermometer.	Nos. 2	Rs.	1,320.00
3.	BDF-384-U Balance, Procision-electronic Mettler PC 400 weighing rang 400 gm readability: 0,01 gm precision + 0.005 gm volt. 240 V, 50 cycles.	No. 1	Rs.	30,000.00
4.	Digital relative humidity meter.	Nos. 2	Rs.	24,000.00
5.	Digital hand Thermometer.	Nos 2	Rs.	24,000.00
6.	Aqua - Boy (KPM) Type BM a	Nos. 2	Rs.	18,000.00
7.	Gultan Tastotherm D 1200 Ni cr - Ni A1 50 c0 - 1200 c°	Nos. 3	Rs.	30,000.00
		Total	Rs.	1,28,904.00

Name of Project:- Design and mass production of efficient various capacities natural gas burners

Sr: No.	Specification/Description	Quantity required		Total Cost in Rupees
1.	Orsat gas analyser			
	Gas-310-F Gas Analyser 3 Vessel.	Nos. 2	Rs.	10,560.00
2.	Gas cylinder accessories: GGH-460-C pressure regulator-2 stage as GM-440 -Q but for oxygen.	No. 1	Rs.	2,640.00
3.	GAS-330-X Gase analyser 4-vessel.	No. 1	Rs.	7,920.00
4.	Gas cylinder stand and Trolly GGH-700-gas cylinder Trolly type No. 070 W.	No. 1	Rs.	2,112.00
5.	GGH-760-gas cylinder stand-070 D.	No. 1	Rs.	660.00
6.	THR-600-8 Thermometer, max. & minimum patterns.	Nos. 5	Rs.	1,320.00
7.	High performance digital thermometer Temp range (-50 c°-to-999 c°) (3412-03)	Nos. 2	Rs.	42,000.00
		Total	Rs.	67,212.00

Name of Project:- Low cost solar water heater for rural Areas in particular and in Urban Areas in General.

Sr. No.	Specification/Description	Quantity required		Total cost in Rupees
1.	XHE-700-A Solar panel .	Nos. 2	Rs.	1,320.00
2.	Solar Minilaboratory.	No. 1	Rs.	34,000.00
3.	Air-cooled-Argon Ion Laser-model 162A Scientific.	No. 1	Rs.	2,52,000.00
		Total	Rs.	2,87,320.00

Name of Project:- Noise measurement and analysis.

1.9	Broad sectrum frequency analyser) with accessories.	No. 1	Rs.	5,00,000.00
		Total	Rs.	5,00,000.00

(d) DEPARTMENT OF AGRICULTURAL ENGINEERING

Name of Project:- Development of small self propelled sugar cane harvester for small and medium land holders of Pakistan.

Sr: No.	Specification/Description	Quantity required	Total cost in Rupees	
1.	Techometer Digital	Three	Rs.	8,000.00
2.	Petrol Engine	One	Rs.	15,000.00
3.	" "	One	Rs.	20,000.00
4.	" "	One	Rs.	25,000.00
5.	Diesel Engine	One	Rs.	20,000.00
6.	" "	One	Rs.	25,000.00
7.	" "	One	Rs.	30,000.00
		Total	Rs.	1,43,000.00

Name of Project:- Evaluation of Draftability as affected by soil type & type of implement to improve tillage practices in North West Frontier Province.

Sr: No.	Specification/Description	Quantity required	Total cost in Rupees	
1.	Test Bed.	One	Rs.	1,00,000.00
2.	Trolly Dynamometer.	One	Rs.	1,20,000.00
3.	Draft Dynamometer 20 Kg	One	Rs.	5,000.00
4.	" " 50 Kg	One	Rs.	10,000.00
5.	" " 75 Kg	One	Rs.	15,000.00
6.	" " 125 Kg	One	Rs.	25,000.00
		Total	Rs.	2,75,000.00

(c) DEPARTMENT OF MINING ENGINEERING

Name of Project:- Processing of lead-zinc ore in Hazara District by new processes.

(a) Selective flocaulation/flotation.

(b) Gavvity separation using slims tables.

Sr. No.	Specification/Description	Quantity required		Total cost in Rupees
1.	Lamps for Atomic Absorption Spectrometer for analysis of mineral elements Model-Alpha-1.	10	Rs.	50,000.00
2.	Muffle furnace 1200 C° Model M4	1	Rs.	20,000.00
3.	Distilled water equipment T+H Stripaction still wall bracket.	1	Rs.	1,000.00
4.	T+H Stirrer hot plate.Cat No.0900317	1	Rs.	2,000.00
5.	Thermostatic water bath Jb 2 Cat No. 0540234.	1	Rs.	12,000.00
6.	Dual range electronic balance Model 36 EH/CO standard Cat No.0520731.	1	Rs.	15,000.00
7.	Dual range electronic balance Standard 22 CH/02	1	Rs.	10,000.00
8.	Plastic beakers Cat. No.03000179	1 Dozen	Rs.	300.00
9.	Stirrer RZR 50 Cat. No.06309987	1	Rs.	1,000.00
10.	PH meter model 7045	1	Rs.	10,000.00
11.	Pressure filter drum	1	Rs.	20,000.00
12.	Mozley table.	1	Rs.	60,000.00
13.	Miscellaneous chemicals.	Various	Rs.	10,000.00
i)	K-ethy xanthate			
ii)	Sodium silicate			
iii)	Carboxy methy cellulose.			
iv)	Formeldyhide.			
v)	Carbon disulphide.			
vi)	Anion nonionic polyacrylomides.		Total Rs.	2,11,300.00
vii	Polyacrylate			
viii)	Poly phosphates			
ix)	Sodium hydroxide.			
x)	Polyethylenoxide.			

(1)Department of Electrical Engineering

1) Electronics Engineering Lab.

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Audio Oscillator different types	20			1959 - 60	Working Condition
2	Signal Generator different types	9			〃	〃
3	Frequency Counter	1			〃	〃
4	Oscilloscope different model	9			〃	〃
5	Power supply different range	12			〃	〃
6	Battery Charger	1			〃	〃
7	T.V. Philips	1			〃	〃
8	T.Vs Sony	2			〃	〃
9	T.V test pattern Generator	1			〃	〃
10	V.C.R's National G/300	2			〃	〃
11	Projector	3			〃	〃
12	Projector Screens	5			〃	〃
13	Variac	4			〃	〃
14	Rheostate	2			〃	〃
15	Impedance Bridge	2			〃	〃
16	Tube Tester	2			〃	〃
17	Amplifier	2			〃	〃
18	Tap Recorder	3			〃	〃
19	Receivers & Experiment Board	3			〃	〃

2) Communication Lab.

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Marconi's Micro Wave Branch	1	England		1980 - 81	Working Condition

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
2	Marconi's Antenna Branch	1	- ditto -		〃	〃
3	Feed backs anttenna Demonstrator	1	- ditto -		〃	〃
4	Feed backs Communications Experiment Set	1	- ditto -		〃	〃
5	G.R. slotted-line with accessories	1	U.S.A.		〃	〃
6	Oscilloscopes varous Trokenwood	4			〃	〃
7	DC Power supplies	2	Japan		〃	〃
8	Electronic Counters	4	Japan		〃	〃
9	Audio Generators	4	Japan		〃	〃
10	Heath kits Microprocessor Learning kit	2	U.S.A.		〃	〃

3) High Voltage Lab.

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Electrolyte Tank				1978-79	Working Condition
2	Oil testing set	1	Poland		〃	〃
3	Drying Oven	1	- ditto -		〃	〃
4	Model of Long Transmission Line	1	- ditto -		〃	〃
5	D.C. (H.V) Generator 50KV	1	Milano		〃	〃
6	Control Panel for HVDC gen 50 KV	1	- ditto -		〃	〃
7	HVAC testing transformer 5 KVA	1	England		〃	〃
8	HVAC testing kit 30 KV	1	Japan		〃	〃
9	HVDC testing kit 30 KV	1	- ditto -		〃	〃
10	Schering bridge with CRO	1	- ditto -		〃	〃
11	Van-de-Graff Generator	1	England		〃	〃
12	Impulse generator 400 KV	1	- ditto -		〃	〃
13	Voltage doubler (HVDC) kit 400 KV	1	- ditto -		〃	〃
14	Power factor test set	1	- ditto -		〃	〃
15	Partical Discharge detector	1	U.S.A.		〃	〃
16	Single beam impulse oscilloscopes with Transient Analyzer	1 1	Holland England		〃 〃	〃 〃

4) Machine Lab.

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
1	D.C. Compound Motor	1	U.S.A.	110 V, 1450 r.p.m. 6.75H	1955	Working Condition
2	D.C. Generator Shund Wound	1	U.S.A.	100 V, 4-KW, 1450 r.p.m.	〃	〃
3	Motor/Generator Set	1	U.S.A.	-	〃	〃
4	D.C. Motor Shund Wound	1	U.S.A.	110 V, 1450 r.p.m. 18.2 Amp.	〃	〃
5	D.C. Generator Shund Wound	1	U.S.A.	2 KW, 1450 r.p.m. 18.2 Amp.	〃	〃
6	Motor/Generator Set	1	U.S.A.	-	〃	〃
7	D.C. Motor Shunt Wound	1	U.S.A.	4 H.P, 35 Amp.	〃	〃
8	D.C. Shund Generator Compound	1	U.S.A.	110 V, 2.5 KW, 1450 r.p.m.	〃	〃
9	D.C. Motor Shunt Wound	1	U.S.A.	110 V, 2 H.P, 1450 r.p.m.	〃	〃
10	Motor/Generator Set	1	U.S.A.	-	〃	〃
11	A.C. Motor	1	U.S.A.	135 V, 1450 r.p.m., 31 Amp.	〃	〃
12	D.C Generator Shunt Wound	1	U.S.A.	220 V, 4 KW, 1440 r.p.m.	〃	〃
13	A.C. Motor & Generator Set	1	U.S.A.	-	〃	〃
14	Induction Motor	1	U.S.A.	1-Phase, 135 V, 1450 r.p.m., 50 Amp.	〃	〃
15	D.C. Generator Shunt Wound	1	U.S.A.	220 V, 4KW, 18.2 Amps.	〃	〃
16	Induction Motor	1	England	1-phase, 135V, 5 H.P Commutator type	〃	〃
17	Induction Motor with Regulator	1	England	-	〃	〃
18	Induction Motor 3-phase	1	England	3 phase, 135 V, 5/1-67 H.P, 1980/660 r.p.m.	〃 〃	〃 〃
19	Induction Regulator	1	England	3 phase, 135 V, 7.6 Amps., 1.6 KVA	〃	〃
20	A.C. Synchronous Motor/Generator	1	England	12 H.P 10 KVA, 1-3-6 Phase	〃	〃
21	Synchronous motor	1	England	15 H.P 400 V, 19.2 Amps. 3-phase,	〃	〃
				1500 r.p.m.	〃	〃
22	Model of three phase network load Reactor	1	England	TB41	〃	〃
23	Rectifier	1	England	400/440 V, 50 HZ, 3-phase, 40 Amps	〃	〃
24	Transformer	1	England	3-phase, 10 KVA, 400/35 V 50 HZ	〃	〃
25	Transformer 3-phase	1	England	3-phase, 10KVA, 400/110V, 14.4/52.5A	〃	〃
26	Electronic Wattmeters	1	Poland	-	〃	〃
27	AEG Set	1	Germany	Combined AC/DC Experimental desk, 220V	〃	〃

5) Measurement Lab.

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Low Load wheat Stone Bridge	1	England	Model RM 196 No. 7835	1956-57	Working Condition
2	Universal impedence bridge	2	England	Model UB 202 MKTV S.No. 8800	〃	〃
3	Oscillograph	1	England	Model 1049 MKIV S.No. 5577	〃	〃
4	A.C. Potentionsetter	3	England	D.C. Galls-Coordinator type 3073	〃	〃
5	Shearing Bridge Consist of ; a. Bridge CA 161 A, b. 1000 Cycles Amplifier L-68, c. Oscillator L.O 66 D.	1	England	-	〃	〃
6	Galvanometer	1	England	Type S.S.I 50 with shunt	〃	〃
7	Kelven Double bridge type	1	England	1122	〃	〃
8	Resistance Box	2	England	Type 4231-6-LF3	〃	〃
9	Non Inductive bridge Ratio Box	3	England	Type 4065	〃	〃
10	Capacitance bridge	2	England	Type 3392 S.E. 25	〃	〃
11	Attenuator	1	England	Type 4617	〃	〃
12	Phase shifting transformer	2	England	Type 4340	〃	〃
13	Phase shifting transformer	1	England	Type 4341	〃	〃
14	Capacitance substitution	1	England	-	〃	〃
15	Strobo Scope	1	England	-	〃	〃
16	Power Supply	6	England	S.No. 30305	〃	〃
17	Variac	15	England		〃	〃
18	Artificial Transmission Line	1	England	-	〃	〃
19	Sine, Spure Oscillator	1	England	Model LF 1	〃	〃
20	R.F. Generator	1	Taiwan	GRG 450	〃	〃
21	Capacitance substitution Box	6	England	(1-10) NF	〃	〃

6) Computer Lab.

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
1	80286 PC	1				Working Condition
2	Logic Analyzer PC Based	1				〃

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
3	Logic Lab. Kits	1				〃
4	LCR Meter	1				〃
5	Stabilizer SVC-1000N	1				〃
6	Eprom Writer	1				〃
7	Consumable IC Chips	1				〃
8	Eprom Erase	1				〃
9	Data book for IC'S	1				〃

(2)Department of Mechanical Engineering

1) Automobile Engineering Lab.

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Crakcase with crankshaft	1	U.S.A.	For demonstration	1960	In working order
2	Gear box (Sliding gear type)	1	〃	〃	〃	Not in working order
3	Petrol engine (sectional)	1	〃	〃	〃	In working order
4	Diesel engine (sectional)	1	〃	〃	〃	Not in working order
5	Various parts of engine	-		〃		
6	Gear box (Front wheet drive)	1	Japan	〃	1972	In working order
7	Honda G-42 (sectional)	1	〃	〃	1975	〃
8	Yamaha engine (sectional)	1	〃	〃	〃	〃
9	Fiat car chassis (complete)	1	Italy	〃	1985	〃
10	Four stroke model	1	U.S.A.	〃	1960	Not in working order
11	Two stroke model	1	U.K.	〃	1986	In working order
12	Opposed cylinder type engine	1	U.S.A.	〃	1960	〃

2) Refrigeration and Air conditioning Lab.

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Recirculating Aid conditioning Unit	1	P.A. Hilton Ltd. (U.K.)	Experiments on Psychrometry can be conducted.	1985	In working order
2	Vapour Compression Refrigeration Unit	1	P.A. Hilton Ltd. (U.K.)	Measurement of C.O.P. of Machine	〃	In working order
3	Technovate Vapour Compression Refrigeration Unit	1	Technovate (U.S.A.)	Can be used for refrigeration and pump.	1977	In working order
4	Free and Forced Convection heat transfer	1	Scott. Engg. Sciences (U.S.A.)		1963	Not in working order
5	All-year Air conditioning Unit	1	Buffalo Forge Co. (U.S.A.)	Summer and Winter air conditioning	1962	In working condition

S.No.	Name of Equipment	Number /Q' ty	Make & Model	Short Specification	Year of Installation	Present Status
6	Double pipe heat exchanger	1	Scott. Engg. Siences (U.S.A.)	Heat transfer through heat exchanger	1978	In working condition

3) Metallurgy Lab.

S.No.	Name of Equipment	Number /Q' ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Projection type metallurgical microscope with camera	1	Leitz (Ger.)	To examine the micro structure of metals.	1960	In working order
2	- ditto -	1	Unimet (USA)	- ditto -	1984	
3	Micro Vickers hardness tester	1	Torsee (Jap)	To find out the hardness number.	1984	In working order
4	Specimen polisher	1	Buehler (USA)	Specimen preparation for micro examination	1984	- ditto -
5	Metallurgical miscoscope	2	American Optical Co. (USA)	To study micro structure	1960	Not in working order
6	Binocular microscope	1	Bino Max Beck London (UK)	For micro structure Examination	1960	In working order
7	Standard specimen polisher	1	Buehler Ltd. (USA)	Sample preparation	1960	In working order
8	Four spindle grinding and polishing m/c	1	E.Leitz (Ger)	- ditto -	1960	Not in working order
9	Universal hardness testing machine	1	Wolpert (Ger)	For finding hardness No.	1960	Not in working order
10	Three spindle grinding and polishing m/c		Buehler Ltd. (USA)	Specimen preparation	1984	
11	Electric Furnace	2	Heraeus/Gebrs Ruhstat	Temp. 1150-1400℃ for heat treatment	1960	In working order
12	Magnetic Crack detector	1	Mitropolitan Vickers Co. (UK)	To find the surface cracks in metals	1960	In working order
13	Dynamic Fatigue testing m/c	1	Avery	To draw S-N curve and finding the fatigue ltd.	1960	Not in working order

4) Production Engineering Lab.

S.No.	Name of Equipment	Number /Q' ty	Make & Model	Short Specification	Year of Installation	Present Status
		Nil				

5) Theory of Machines Lab.

S.No.	Name of Equipment	Number /Q' ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Gear Train Apparatus	1	Norwood Instruments (U.K.)	Demonstration of simple and compound gear train and epicyclic gear train	1968	
2	Rotary balancing apparatus	1	- ditto -	Explaining the principle of revolving masses.	1970	
3	Whirling shaft apparatus	1	- ditto -		1968	Not in working order
4	Cam and Tappet Mechanism	1	- ditto -	Construct of cam profile	1965	
5	Quick return motion mechanism	1	- ditto -	Demonstration of ratio of return to cutting strokes of shaping m/c	1965	
6	Nortness Governer	1	Norwood Instruments (U.K.)	Calculation of equilibrium speed	1970	
7	Gear Kinematics apparatus	1	MT 240	Explanation of Kinematics of gears	1968	
8	Scotch Yoke mechanism	1	Norwood Instruments	Explanation of double slider crank chain	1965	
9	Free and Forced Vibration appratus	1	Cussons (UK)		1977	Not in working order

6) Heat Engine Lab.

S.No.	Name of Equipment	Number /Q' ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Knock Testing Machine	1	Hermann (Ger)	Fuel Knock Value determination	1970	In working order
2	Stuwart Diesel Engine with Electronic Dynomometer	1	Stuwart Turner (U.K.)	I.H.P., B.H.P. and Heat Balance sheet calculation	1968	In working order

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
3	Diesel Generator Set	1	Aggregate		1961	In working order
4	Two stage Air compressor	1	Plint and Partners Ltd (U.K.)	Air Compression in two stages	1987	In working order
5	Herford Diesel Engine	1	U.K.	I.H.P. and B.H.P. calculation	1961	In working order
6	Crossley Diesel Engine	2	U.K.	I.H.P. and B.H.P.	1960	In working order
7	Buke Petrol Engine with Generator/ Dynometer	1	Dynamation Corp. (USA)		1963	Not in working order
8	Gas turbine unit	1	Cusons (U.K.)	Study of Joule cycle	1979	
9	Sub Sonic Ram Jet	1	P.A. Hilton Ltd. (U.K.)	Study of Ram jet	1988	In working order
10	Car Demonstration Model	1	(Italy)	Demonstration	1987	In working order

7) Fuel Laboratory

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Bomb Calorimeter	1	England	Experiments	1960	Not in working order
2	Oscilloscope	1	Germany	Experiments	1960	Not in working order
3	Analog Fluid Circuit	1	U.K.	Experiments	1960	Not in working order
4	Emersion Fuel Calorimeter	1	U.K.	Experiments	1960	Not in working order
5	Microscope	1	Germany	Experiments	1960	Not in working order
6	Orset Gas Analyser	2	U.K.	Experiments	1960	Not in working order
7	Secol Viscometer	1	U.K.	Experiments	1960	Not in working order
8	Emersion Fuel calorimeter (Bomb)	1	U.K.	Experiments	1960	Not in working order
9	Distillation Appt.	1	U.K.	Experiments	1960	Not in working order
10	Cloud and Pour Test Appt.	1	U.K.	Experiments	1960	Not in working order

8) Power Plant Lab.

S.No.	Name of Equipment	Number /Q' ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Steam Boiler	1	John Thomson (U.K.)(1962)	Fire Tube Boiler with 100 P.s.i. working pressure, Heating surface 466 ft2	1964	In working order
2	Steam Engine	2	John Thomson (U.K.)(1962)	Reciprocating Steam engine compound type	1964	In working order
3	Steam Turbine Generator set	1	John Thomson (U.K.)(1962)	Impulse type of steam turbine with electric generation	1964	In workig order

(3)Department of Civil Engineering

1) Structural Engineering Lab.

S.No.	Name of Equipment	No. /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
1	200 KN Straining Frame with Single Acting Jack for Static Load with Dynamometer Mp 146	1	Maurice Perrier France	5 M Bed, Used for Flexure Tests on Beams with single Point Load or Line Load	1982/83	In working order
2	30 Ton Compression machine	1	Controls Model C 21 Milano, Italy 1983	Used for Compression Tests on Small Specimen	1984/85	In working order
3	Profometer	1	Maurice Perrier France	With Spot Probe and Depth Probe	1984	In working order
4	Linear Voltage Differential Transducers	16	KYOWA, DT-50A	Sensitivity 1.5mV/V ±20%	1984	Incomplete
5	Data Logger	1	KYOWA, UCAM-5BT	Digital Measuring Instrument 10 Point Scanner	1984	Not Used
6	Portable Strain Indicator P-350A	1	Micro Measurement USA P-350A	For Measuring Strains using Electrical Resistance Strain Gauges	1984	In working order
7	Portable Strain Indicator P-3500	1	Perrier France P-3500	For Measuring Strain using Electrical Electrical Strain Gauges	1985/86	In working order
8	Ten Channel Switching & Balancing Unit SB-1	1	Micro Measurement USA SB-1	10 Channel Switching Unit	1984	In working order
9	Schmidth Hammer with Anvil	1	Perrier France	with Recording Device	1984	In working order
10	Portable Ultrasonic Non-destructive Digital Measuring Tester (PUNDIT)	1	Perrier France	For Non-Destructive Tests using Ultrasonic Pulse	1984	Unreliable Performance, not satisfactory, not working
11	Dial Indicators	6	EL 25-814	50 mm. travel	1984/85	In working order
12	Dial Indicator	6	EL 29-074	2 in. travel	1984/85	In working order

2) Public Health Engineering Lab.

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Floc Tester	2	HACH R15075	-	1989	Functioning

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
2	Auto Clave	1	Basildon	-	- ditto -	- ditto -
3	PH Meter	3	HACH R43800	-	- ditto -	- ditto -
4	Hot Box	1	Cat No. OVB 305 England	-	- ditto -	- ditto -
5	Economy Incubator	2	Cat No. INA 305 England	-	- ditto -	- ditto -
6	Bacteriological Kit	1	US R.No.6665-0-682-4765	-	- ditto -	- ditto -
7	B.O.D. Apparatus	2	HACH R21738	-	- ditto -	- ditto -
8	Vacuum Pump	1	US R5522050	-	- ditto -	- ditto -
9	Analytical Balance	1	Germany Type A200S	-	- ditto -	- ditto -
10	C.O.D. Reactor	2	HACH R1650	-	- ditto -	- ditto -
11	Water Bath	2	Cat No. 900, 300 England	-	- ditto -	- ditto -
12	Portable Dissolved Oxygen	2	HACH R16046	-	- ditto -	- ditto -
13	Portable Turbidity Meter	2	HACH R16800 HACH R2100P	-	- ditto -	- ditto -
14	Furnace	1	CAT No FSE285 England	-	- ditto -	- ditto -
15	Colony Counter	2	HACH R3325	-	- ditto -	- ditto -
16	DR/3 Spectrophotometer	2	HACH R41700 HACH R2000	-	- ditto -	- ditto -
17	Microscope	1	OLYMPUS BH-2	-	- ditto -	- ditto -
18	Distillator	1	TYPE L4 England	-	- ditto -	- ditto -
19	Drier	1	TYPE 3SS Eng.	-	- ditto -	- ditto -
20	Dissicator	1	-	-	- ditto -	- ditto -
21	Magnetic Stirrer	2	CAT No.SWT 315 England	-	- ditto -	- ditto -

3) Soil Mechanics Lab.

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Sieve Analysis Set	2	US Standard Sirves Set	Fine Sieves	1953	Functioning
2	Liquid Limit Set	1	Soil Test USA	-	- ditto -	- ditto -
3	Plastic Limit Set	1	- ditto -	-	- ditto -	- ditto -
4	Shrinkage Limit Set	1	- ditto -	-	- ditto -	- ditto -
5	CBR Apparatus	2	- ditto -	-	- ditto -	- ditto -
6	Field Density Kit	2	- ditto -	-	- ditto -	- ditto -
7	Proctor Penetrometer	2	- ditto -	-	- ditto -	- ditto -
8	Consolidation (Fixed Type)	2	- ditto -	-	- ditto -	- ditto -
9	Consolidation Specimen Trimmer	1	- ditto -	-	- ditto -	- ditto -
10	Auger Set	1	- ditto -	-	- ditto -	- ditto -
11	Improved ASTM Hydrometer	2	- ditto -	-	- ditto -	- ditto -
12	Mechanical Stirrer	1	- ditto -	-	- ditto -	- ditto -
13	Sample Splitter	1	- ditto -	-	- ditto -	Broken
14	Oven	2	-	-	- ditto -	Damaged
15	Hydraulic Sample Ejector	2	-	-	- ditto -	Functioning
16	Triple Beam Balance	1	-	-	- ditto -	- ditto -
17	Solution Balance	1	-	-	- ditto -	- ditto -
18	Portable Sieve Shaker	1	-	-	- ditto -	- ditto -
19	Los Angeles Abrasion Machine	1	-	-	- ditto -	- ditto -
20	Unconfined Compression Apparatus	2	-	-	- ditto -	- ditto -
21	Direct Shear Hard Apparatus	2	-	-	- ditto -	- ditto -
22	Sand Absorption Cone & Tamper	1	-	-	- ditto -	- ditto -
23	Pycnometer	1	-	-	- ditto -	- ditto -
24	Density Basket	1	-	-	- ditto -	- ditto -
25	High Temperature Burners	1	-	-	- ditto -	- ditto -
26	Softening Point Apparatus	1	-	-	- ditto -	- ditto -
27	Flash Point Tester	1	-	-	- ditto -	- ditto -
28	Viscosimeter	1	-	-	- ditto -	- ditto -
29	Penetrometer Universal	1	-	-	- ditto -	- ditto -
30	Extractor (Hand Driven)	1	-	-	- ditto -	- ditto -

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
31	Distillation Apparatus	1	-	-	- ditto -	- ditto -
32	Tripod with Concentric Rings Set	1	-	-	- ditto -	- ditto -
33	Sieve Set (8" Dia.)	1 set	US Std. Sieve	Coarse Sieves	- ditto -	- ditto -
34	Electric Hot Plate	1	-	-	- ditto -	- ditto -
35	Gas Hot Plate	1	-	-	- ditto -	- ditto -
36	Specific Gravity Bottle	1	-	-	- ditto -	- ditto -
37	Balances	1	-	-	- ditto -	- ditto -
38	Sieve Shaker	1	-	-	- ditto -	- ditto -
39	Microscope	1	-	-	- ditto -	- ditto -
40	Yield Bucket (0.5 cft)	1	-	-	- ditto -	- ditto -
41	Speedy Moisture Tester	1	-	-	- ditto -	- ditto -
42	Proctor Penetrometer	2	-	-	- ditto -	- ditto -
43	Tri-Axial Test Set	1	-	-	- ditto -	- ditto -
44	Plate Bearing Capacity Apparatus	1	-	-	- ditto -	- ditto -
45	Versa Tester	1	-	-	- ditto -	- ditto -
46	Field Vane Apparatus	1	-	-	- ditto -	- ditto -
47	Pocket Penetrometer	1	-	-	- ditto -	- ditto -
48	VP Value Set	1	-	-	- ditto -	- ditto -
49	Terra Scout Set	1	-	-	- ditto -	- ditto -
50	Kango Electric Hammer	1	-	-	- ditto -	- ditto -
51	Permeability Apparatus	1	-	-	- ditto -	- ditto -
52	Darrel Machine	1	Perrier France	-	- ditto -	- ditto -
53	Ultra Sonic Concrete Test Appratus	1	-	-	- ditto -	- ditto -
54	Centrifuge	1	-	-	- ditto -	- ditto -
55	Oven (Large Size)	1	-	-	- ditto -	- ditto -
56	Concrete Core Driller	1	ELE England	-	- ditto -	- ditto -
57	Aggregate Crushing apparatus	1	-	-	- ditto -	- ditto -
58	Triple Beam Balance	1	-	-	- ditto -	- ditto -
59	Auto Compaction Machine	1	Farnell	-	- ditto -	- ditto -

4) Hydraulics & Fluid Mechanics Lab.

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Single Stage Centrifugal Pump (Self Contained Unit)	1	Pling & Partner England	For Characteristic Study	1960	In Working Order
2	Flow Visualisation Tank	1	Armfield	To study the flow around Models of Structures	1966	In Working Order
3	Tilting Flume - 16 M long with accessories	1	Plint	To study flow over weirs, hydraulic jump etc.	1987	In Working Order
4	Water Hammer Apparatus	1	Armfield	To study Waer Hammer Pressure in pipes	1960	In Working Order
5	Flow Through Orifice	1	CSU Hydraulic Lab. Shop	To find the Coe		
6	Airflow Venturimeter	1	Airflow Development (High Wycombe)	To measure the Air Discharge	1966	Not in Working Order
7	Pelton Wheel	1	Escher Wyss Zurich	To determine the Characteristics of Turbine	1960	In Working Order
8	Double Stage Centrifugal Pump	1	Escher Wyss Zurich	To determine the Characteristics of Double Stage Centrifugal Pump	1960	In Working Order
9	Propeller Pump	1	Overtikon Engg. Pump	To determine the Characteristic of Axialflow Pump	1960	In Working Order
10	Glass Flume Non-Tilting	1	CSE Hyd. Lab. Shop	Hydraulic Jump Exp.	1960	In Working Order
11	Hydraulic Bench with accessories	1	Techquipment Ltd.	-	1967	In Working Order

5) Concrete Technology Lab.

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Autoclave Machine	1	Sr. No. 668/195T	350 psi Capacity	-	Functioning
2	Compression testing Machine 110T	1	Maruto, Japan	for Comp. Test on Conc.	-	Out of Order

S.No.	Name of Equipment	Number /Q'ty	Make & Model	Short Specification	Year of Installation	Present Status
3	Compression Testing Machine 150MT	1	Kadeer Bros. Pakistan	- ditto -	-	Out of Order
4	Flexure Testing Machine 10 KN	1	Perrier, USA	For Bending Tests on Small Beams etc. 10 KV Capacity	-	Functioning
5	Compression Testing Machine	1	Soil Test, USA	200 Kips Capacity	-	Out of Order
6	Compaction Factor Appratus	1	Farnell, England	-	-	Functioning
7	Concrete Vibrator	1	-	-	-	Functioning
8	Cylinder Capping Jig	1	Central Scientific Co., USA	Used for Capping of Concrete cylinders	-	Functioning
9	Compressometer	1	-	-	-	Functioning
10	Air Entraining Appratus	1	Soil Test, USA	Used for making air entrained concrete	-	Functioning
11	Electrical Oven Cupboard	1	-	-	-	Functioning
12	Soil Cement Block Making Machine	1	-	-	-	Functioning
13	Sieve Analysis Set (Fine Agg.)	1	Local made	For Sieve analysis of fine aggregate (BSS)	-	Sieve #200 is missing.
14	Sieve Analysis Set (Coarse Agg.)	1	Local made	For Sieve analysis of coarse aggregate (BSS)	-	Functioning
15	Vicat Needle Apparatus	10	-	-	-	Functioning
16	Concrete Mixer Electric	1	-	-	-	Functioning
17	Shrinkage Apparatus	1	-	-	-	Functioning
18	Turbidity Meter	1	-	-	-	Functioning
19	Sieve analysis set	1	Local made	For Sieve analysis of fine aggregate (ASTM)	-	Sieve #200 is damaged.
20	Sieve analysis set	1	Endecotts Ltd. Eng.	For coarse aggregate sieve analysis (US std.)	-	Functioning
21	Conc. Cube Moulds (6"x6"x6")	12	-	-	-	Functioning
22	Mortor Cube Moulds (2"x2"x2")	6	-	-	-	Functioning
23	Conc. Cylinder Moulds (6"x12")	10	-	-	-	Functioning

6) Survey Lab.

S.No.	Name of Equipment	Number /Q' ty	Make & Model	Short Specification	Year of Installation	Present Status
1	Theodolite (Vernier)	4	-	One Minute Accuracy with Standard Accessories, Graduated on Degree System	1955	Functioning
2	Theodolite (Micro-Optic)	6	TI-A	10 Seconds Accuracy Graduated on Grade System	1961	- ditto -
3	Theodolite (Micro-Optic)	6	T2	One Second Accuracy, Graduted on Grade System	1961	- ditto -
4	Theodolite (Compass)	4	To	One Second Accuracy, with magnetized scale	1961	- ditto -
5	Theodolite (Electronic Digital)	6	Th-E10D, Pentax Japan	One Second Accuracy, graduated both in Degrees & Grades	1988	- ditto -
6	Level (Dumpy)	4	Wild NK-01S	-	1961	- ditto -
7	Level	1	Wild N-2	-	1961	- ditto -
8	Level (Quick Set)	3	Meopta	-	1963	- ditto -
9	Level (Quick Set)	4	Meopta	-	1963	- ditto -
10	Levels (Tilting)	6	Wild N-10	-	1961	- ditto -
11	Levels (Precise)	1	Wild N-3	-	1961	- ditto -
12	Level (Hand)	9	Keuffel & Ersserco	-	1963	- ditto -
13	Engineers Chain	34	-	100 ft. Length	1963	- ditto -
14	Prismatic Compass	39	-	Graduated in Degrees, 15' accuracy	1963	- ditto -
15	Surveyor's Compass	1	-	15 ft. Length	1963	- ditto -
16	Steel Band	35	-	100 m Length	1963	- ditto -
17	Plane Tables	21	Pak Made	With satndard accessories	1963	- ditto -
18	Planimeters	10	K&E, Germany	Accuracy 0.01 in2	1963	- ditto -
19	Stereoscopes	6	Pak Made	-	1963	- ditto -
20	Radial Line Plotter	1	Hilger & Watts	-	1963	- ditto -
21	Subtens Bars	2	Wild, 1964	-	1963	- ditto -
22	Reduction Meter	2	Wild-RDS	Graduated on Grade system	1963	- ditto -
23	Altimeter	6	Sweden, 1963	-	1963	- ditto -
24	Binoculars	11	USA, 1963	-	1963	- ditto -