

## 10 RESOURCE REQUIREMENT

For any programme to be offered, three basic resources required viz:

- Physical,
- Human and
- Financial

### 10.1 Physical Resources

These include space requirement, building, equipment etc.

#### 10.1.1 Space requirement

Norms and standards laid down by All India Council for Technical Education (AICTE) are to be followed to work out space requirement in respect of class rooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

The space requirement is calculated as:

	Unit Area (Sq.m)	Qty	Total Area (Sq.m)
Class rooms	75	2	150
Space for Laboratories	90	6	450
Office space	50	1	50
Faculty rooms	20	8	160
Store Section	50	1	50
Maintenance Section	50	1	50
<b>Total</b>			<b>910</b>

### 10.1.2 List of Equipment for Instrumentation and Control

Sr. No	Equipment	Qty	Price per unit in Rs
<b>BIOMEDICAL ENGINEERING LABORATORIES</b>			
1.	Polyrite	1	1,50,000/-
2.	ECG Machine	1	17,000/-
3.	Pulse (Bio Feedback) Trainer	1	13,000/-
4.	EEG (Bio Feedback) Machine	1	17,000/-
5.	GSR (Bio Feedback) Machine	1	8,000/-
6.	Temfor (Bio Feedback)	1	12,000/-
7.	EMG (Bio Feedback) Machine	1	14,000/-
8.	Computer system along with multimedia, printer UPS etc.	1	60,000/-
9.	Hemoglobin Analyzer	1	3,000/-
10.	Electro sleep Apparatus	1	6,000/-
11.	Relevant Software Packages (LS)		50,000/-
<b>CONTROL LABORATORY</b>			
1.	AC Servo Motor Speed Torque Kit	1	10,000/-
2.	DC Position Servo System	1	8,000/-
3.	Process Control Simulator	1	45,000/-
4.	Stepper Motor Study Kit	1	12,000/-
5.	Linear System Simulator	1	7,000/-
6.	Temperature Control System	1	8,000/-
7.	Compensation Design	1	7,000/-
8.	Relay Control System	1	7,000/-
9.	Potentiometric Error Detector	1	4,000/-
10.	Computer system along with multimedia, printer UPS etc.	1	60,000/-
11.	Relevant Software Packages	1	50,000/-
12.	Process Control Simulator Trainer	1	2,00,000/-
13.	PLC Kit with starter control and star delta starter, sequential switching of motor board, water level control, fan control simulator, seven segment display, lift control, pick and place control	1	90,000/-
14.	On/off temperature Controller (indicator cum controller)		
15.	DC Position servomechanism Demonstrator		
16.	DC Motor speed control trainer kit		
17.	DC Voltage Regulator (Closed Loop)		
18.	Synchro Transmitter-Receiving Pair		
19.	PID controller(Analog Type)		
20.	PID controller (Microprocessor based)		
21.	Water level controller (ON/OFF mode)		

Sr. No	Equipment	Qty	Price per unit in Rs
22.	AC position control system		
23.	PID simulator		
24.	Digital control trainer		
25.	Light intensity control trainer		
26.	DC position control		
27.	Designed evaluation of P,PI,PD,PID controller		
28.	Simulation for instrumentation & Control system (Position system)		
29.	Pressure measurement using pneumatic transmitter		
30.	Different pressure measurement using PDPT		
31.	Realization of various process lag		
32.	Realization of electronic/pneumatic/hydraulic transmitter		
33.	Realization of functioning if flapper-nozzel arrangement		
34.	Input/output characteristics of an Electro-pneumatic converter		
35.	Sequencing and interlocking in system		
36.	Feed forward control system kit		
37.	Cascade control system kit		
38.	Ratio-control system kit		
39.	Split-range control system kit		
<b>TRANSDUCER LABORATORY</b>			
1.	Oscilloscope Recorder	1	3,20,000/-
2.	Transducer and Instruments Kit (Three Port)	1	42,000/-
3.	LVDT (Techno)	1	6,000/-
4.	Transducer Kit (Feedback)	1	CBP 4,000/-
5.	Dead Weight Tester	1	45,000/-
6.	Microcomputer Sensing Control Equipment	1	1,70,000/-
7.	LJ Make Transducer and Instrumentation Trainer	2	CBP 5,000/-
8.	Thermocouple Test Kit Set	2	15,000/-
9.	RTD Simulator	2	1000/-
10.	Computer system along with multimedia, printer UPS etc.	1	60,000/-
11.	Relevant Software Packages	1	50,000/-
12.	Load measurement tutor (load cell)		
13.	Pressure measurement tutor		
14.	Temperature measurement tutor(RTD)		
15.	Temperature measurement tutor(Thermocouple)		
16.	Light measurement		
17.	Torque measurement tutor		
18.	RPM/Speed measurement tutor(Photo-Electric Sensor)		
19.	RPM measurement tutor(electro-magnetic)		
20.	Vibration measurement tutor (Strain Gauge sensor)		
21.	Study of inductive Pick Up		

Sr. No	Equipment	Qty	Price per unit in `
22.	Study of Capacitive Pick Up		
23.	Experimental kit for signal conditioning & temperature display using Analog to Digital Converter		
24.	Inductive & capacitive transducer trainer kit		
25.	Potentiometer, thermistor, thermocouple trainer kit		
26.	Opto-Electronic trainer kit		
27.	Training kit for signal conditions & temperature display using Analog to Digital Converter		
28.	Tachogenerator trainers kit		
29.	Tachometric feedback kit for control of speed of motor along with motor		
30.	Torsion dynamometer kit for measurement of Torque		
31.	Accelerometer kit for measurement of acceleration		
32.	Capacitive transducer kit for measurement of level		
33.	Optical pyrometer to measure temperature		
34.	Thermostat/ bimetallic Switch		
35.	Rotameter / Venturimeter to measure flow		
36.	Glucometer kit to measure Blood Sugar		
<b>MEASUREMENT LAB</b>			
1.	CRO 20 Mhz	3	15,000/-
2.	Digital Storage Oscilloscope(DSO) 80MHz	1	40,000/-
3.	Spectrum Analyzer	1	70,000/-
4.	Precise LCR Meter	1	\$ 17,000
5.	LCR Q meter	1	13,000/-
6.	Function Generator	3	8,000/-
7.	Cromptons Potentiometer	2	8,000/-
8.	Wheat stone Bridge (Various AC Bridges)	2	9,000/-
9.	Digital IC Tester	1	17,000/-
10.	Frequency Meter	1	2,000/-
11.	Decade LCR Boxes	3	4,000/-
12.	Power supplies	4	4,000/-
13.	Tong Tester	4	-
14.	Lux meter	4	-
15.	Digital non-contact tachometer	4	-
16.	Flux meter	4	-
17.	Power Factor Meter	4	-
18.	Frequency meter (Digital)	4	-
19.	Frequency Counter		

Sr. No	Equipment	Qty	Price per unit in Rs
<b>INSTRUMENTATION WORKSHOP</b>			
1.	Oscilloscope 20 MHz	6	15,000/-
2.	Digital Multimeter	3	5,000/-
3.	Compton Potentio meter	1	8,000/-
4.	Digital Potentiometer	1	5,000/-
5.	Laboratory Recorder	1	17,000/-
6.	Pulse Generator	2	7,000/-
7.	Function Generator	2	8,000/-
8.	High Voltage Regulator P/S	4	1,000/-
9.	Digital Calibrator	10	2,000/-
10.	Dual Variable P/S	10	2,000/-
11.	Computer system along with multimedia, printer UPS etc.	1	60,000/-
12.	Relevant Software Packages	1	50,000/-
13.	Analog Multimeter		
<b>MICROPROCESSOR LABORATORY</b>			
1.	Microprocessor Kit 8085	3	4,000/-
2.	Microprocessor Kit 8086	1	8,000/-
3.	Microprocessor Kit 68000	1	10,000/-
4.	EPROM Writer	2	
5.	8051 Micro Controller Kit	2	20,000/-
6.	CD Writer	1	
7.	Scanner	1	
8.	Computer system along with multimedia, printer, UPS etc.	1	60,000/-
9.	Relevant Software Packages	1	50,000/-
<b>HYDRAULIC AND PNEUMATICS LABORATORY</b>			
1.	Digital Calibrator	1	2,000/-
2.	Pneumatic Circuit Trainer Kit with Compressor	1	90,000/-
3.	Indicator and Indicating Controller (Analog Type)	1	15,000/-
4.	Level Process Control Trainer	1	1,60,000/-
5.	Auto-range Digital Multi-meter	1	2,000/-
6.	CD Writer	1	
7.	Scanner	1	
8.	Computer system along with multimedia, printer UPS etc.	1	60,000/-
9.	Relevant Software Packages	1	50,000/-
10.	CD ROM Drive	1	6,000/-
11.	Process Control Model Demonstration bench with remote set point control	1	2,80,000/-

Sr. No	Equipment	Qty	Price per unit in Rs
12.	Hydraulic Trainer Unit	1	US \$ 10,000
13.	Basic Electro pneumatics trainer kit		
14.	Electro hydraulic trainer with PLC		
15.	Pressure control station		
16.	Temperature control station		
17.	Flow control station		
18.	Compressor		
19.	Electro hydraulic Supplementary kit		
<b>ELECTRICAL WORKSHOP</b>			
1.	Battery Charger 0 – 12 V, 20 A	1	2000/-
2.	Heat Convector (Blower Type)	2	1000/-
3.	Earth Leakage Relay 3 phase	1	2000/-
4.	Energy Meter Single Phase	1	800/-
5.	Automatic Starter Electronics	1	1500/-
6.	Drill Machine (Wolf)	1	3500/-
7.	Dimmer stat 230 V (0 – 270 V), 50 Hz, 15 A (Single phase)	2	2000/-
8.	Dimmer stat 230 V (0 – 270 V) 50 Hz, 20 A (Three phase)	2	4000/-
9.	Frequency Meter Analog	1	2000/-
10.	Shaded Pole Motor 0.5 KW, 1 phase, 50 Hz	1	4200/-
11.	Wattmeter 75/300/600 V, 1.5 A, 20 A	2	2000/-
12.	Earth tester 500 V, 100 Ohm, ¾ Terminal	1	4000/-
13.	Cable Cross Section Model	1	3000/-
14.	House Wiring Model	1	4000/-
15.	Bridge Insulation Tester 500 V, 100 m Ohm	1	5,000/-
16.	Bridge Insulation Tester 100 V, 200 m Ohm	1	5,000/-
17.	Automobile Electrical Wiring Model	1	8,000/-
18.	Coil Welding Machine 15' x 14", 152-C	1	2,000/-
19.	Coil Welding Machine 21" x 14", 162-C	1	2,000/-
20.	Megger 500 V	1	2,000/-
21.	Megger 1000 V	1	2,000/-
22.	3-phase Energy Meter 440 V, 10 A	2	1,000/-
23.	Cross Sectional Model of Motor( cut view model)	1	4,000/-
24.	Automatic Coil Wiring Machine Model ER – 001 – C	1	58,000/-
<b>BASIC ELECTRICAL ENGINEERING LABORATORY</b>			
1.	LCR Q meter 20,000 m Farad, 2000 m Farad	1	6,000/-
2.	DC Power Supply 0 – 30 V, 2 A	3	1,000/-
3.	DC Power Supply 0 – 30 V, 3 A	2	3,000/-
4.	DC Power Supply 0 – 30 V, 100 mA	2	3,000/-
5.	DC Power Supply 0 – 300 V, 100 mA	4	5,000/-

Sr. No	Equipment	Qty	Price per unit in Rs
6.	Single Phase Transformer 230 V/115 V, 3 KVA	4	3,000/-
7.	Single Phase Transformer 220 V/600 V, 2 KVA	2	4,000/-
8.	Oil Testing Set	1	10,000/-
9.	Oscilloscope 20 MHz L and T Make	2	13,000/-
10.	3-Phase Transformer 415 V, 50 Hz	2	4,000/-
11.	Relay Testing Kit mode 636	1	14,000/-
12.	3 Digit Multi-meter (MIC – 161 +)	2	2,000/-
13.	Frequency Meter Digital 3.5 digit, 20 – 99 Hz	1	1,000/-
14.	Multi-meter Analog Standard	1	200/-
15.	Portable Power Factor Meter	2	3,000/-
16.	Wattmeter 110/220/440 V, 15 A, 30 A	2	2,000/-
17.	Wattmeter 75/150/300, 1.5 A, 30 A	2	2,000/-
18.	Battery Charger 12/24 V, 30 A	1	3,000/-
19.	Function Generator (Digital Read Out)	2	6,000/-
20.	Wheat Stone Bridge (different AC Bridges)	1	9,000/-
21.	Power Scope Model 522 systronics Make	2	20,000/-
<b>POWER ELECTRONICS LABORATORY</b>			
1.	DC Chopper with firing module 50 V, 2 A	1	11,000/-
2.	Bridge Converters Power Modules + Firing Modules	1	55,000/-
3.	Single Phase half bridge converter (Thyristor based)	1	30,000/-
4.	Single phase inverter firing module UJT firing for SCR	1	15,000/-
5.	R and RC firing circuit	1	2000/-
6.	Pulse Transformer Firing Circuit	1	2000/-
7.	Trainer Kits of SCR, DIAC, TRAIC	1	4000/-
8.	Speed Control of DC motor using SCR	1	5,000/-
9.	Phase Control using SCR/TRAIC (half and full wave)	1	6,000/-
10.	Construction of single phase half and full wave controlled rectifier using SCR	1	4,000/-
11.	Chopper Circuits, Jones and Morgeon FT – 418	1	3,000/-
12.	Relay Demonstration Panel	1	6,000/-
13.	Industrial Control Trainer Kit (15 boards)	1	20,000/-
<b>ELECTRICAL MACHINES LABORATORY</b>			
1.	Motor Starter DOL	3	810/-
2.	Motor Generator Set AC/DC (3-Phase AC Motor as prime mover) with complete panel board starter and field regulator	1	37,500/-
3.	MG Set DC/DC, DC shunt Generator Set coupled with DC shunt motor 3 KW, 1440 mm, 230 V complete with appropriate panel board starter and field regulator	1	27,400/-

Sr. No	Equipment	Qty	Price per unit in Rs
4.	DC shunt motor 230 V, 3 KW, 1440 rpm coupled with DC series generator 230 V, 3 KW complete with panel board with starter and field regulator	1	27,400/-
5.	Tong Tester (Clip on Type)	1	1,450/-
6.	Strobo scope (non contact) digital 3S	1	6,290/-
7.	Single phase Induction Motor (Panel Board)	1	4,875-
8.	SC 21 M, 3-Phase, 415 V, 50 Hz	1	9,000/-
9.	Relay Demonstration Panel	1	92,000/-
10.	Star Delta Starter 5 HP (manual)	2	1,500/-
11.	Rectifier (solid State) input 3-phase 440 V, 50 Hz, output 0 – 250 V, 80A	1	47,000/-
12.	Diesel Engine Set 220 V, 3 KVA with auto shunt down panel coupled with alternator	1	20,000/-
13.	Tachometer Non-contact type	2	
14.	Measuring Instruments (multimeters) Analog type, moving coil and moving-iron, wattmeters, ammeters, power factor meter, frequency meter, phase sequence indicator	LS	50,000/-
15.	Slip ring induction motor coupled with DC Generator (Set)	1	
16.	Synchronous motor coupled with DC Generator with Synchronouse	2	
17.	Three phase motor 5 HP for locked rotor and open circuit test	1	

**NOTE:**

In addition to above laboratories, computer centre will be required for effective implementation of the course. Provision for overhead projector, TV with VCR facility slide cum strip projector, photocopier, PC-XT along with LCD projector facility, drafting machines etc has also to be made.

**10.1.3 Furniture Requirement**

Norms and standards laid down by AICTE be followed for working out furniture requirement for this course.

- Furniture for laboratories 3.5 lacs
- Furniture for Computer Centre 2.0 lacs

**10.2 Human Resources**

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, work load norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE.



**Faculty Requirement:**

It is calculated base on contact hours in theory classes and practical classes. Keeping in view student teacher ratio as 11:1, following faculty strength is required.

Sr. No	Subject	Year			Total
		I	II	III	
1.	Communication skills	1	-	-	1
2.	Mathematics	1	-	-	1
3.	Physics	1	-	-	1
4.	Chemistry	1	-	-	1
5.	Electrical Engineering	-	1	-	1
6.	*Electronics Engineering	-	1	-	1
7.	*Technology Subjects	1	2	4	7
<b>Total</b>		<b>6</b>	<b>3</b>	<b>4</b>	<b>13</b>

**Note:**

Seven positions out of 13 are in the area of instrumentation and control, electronics and computer engineering. Out of these four positions may be filled with persons holding qualification of B.Tech./M.Tech in Instrumentation and Control Engineering.

Following are the qualifications and experience for the teaching faculty and technician staff

Qualification	Experience
<b>Lecturer in Instrumentation Engineering</b> 1 <sup>ST</sup> Class BE/B.Tech in Instrumentation Engineering OR <b>Lecturer in Electronics</b> 1 <sup>ST</sup> Class BE/B.Tech in Electronics and Communication Engineering with specialization in Instrumentation and Control	Nil
<b>Sr.Lecturer</b> 1 <sup>ST</sup> Class BE in Instrumentation Engineering OR 1 <sup>ST</sup> Class ME/M.Tech. in Instruementation Engineering	5 years experience in teaching/ industry/ research at the level of Lecturer or equivalent
<b>Head of Department</b> ME/M.Tech in Instrumentation Engineering	5 years experience in teaching/ industry/ research at the level of Lecturer or equivalent

**Note:**

**Since the norms for qualification are laid down by AICTE. The state Directorate/ Board of Technical Education should consider the latest norms in this regard.**

In addition to above, following support staff will be required:

- |                                 |        |
|---------------------------------|--------|
| 1) Supporting Staff             |        |
| 2) Technicians for laboratories | 4 Nos. |
| 3) Office Assistants            | 1 No.  |
| 4) Steno/Computer Operator      | 2 Nos. |
| 5) Laboratory Attendants        | 2 Nos. |