

## 11. RESOURCE REQUIREMENT FOR INSTRUMENTATION ENGINEERING DEPARTMENT

### 11.1 Physical Resources

#### 11.1.1 Space Requirement:

Norms and standards laid down by All India Council for Technical Education (AICTE) may 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.

#### 11.1.2 Equipment Requirement:

##### List of Labs.

1. Mechanical Measurement Lab.
2. Digital Electronics & Micro Processor Lab.
3. Electrical & Electronic Measurement Lab.
4. Opto & Analytical Electronics Lab.
5. Instrumentation Design Lab.
6. Bio Medical Instrumentation Lab.
7. Process Control Lab.
8. Communication Lab.
9. Industrial Electronics Lab.

**\*Elements of Mechanical Engineering (EME-I&EME-II) and Applied Mechanics equipments are common with the Curriculum for Mechanical Engineering Department.**

*Note :- The items calculated for the batch of 20 students*

#### 1. Mechanical Measurement Lab.

Sr. No.	Description of Item	Quantity
1.	Analytical Balance 0-1/2 kg, +/- 0.02 mg	05
2.	Single Pan Balance 0-10 kg +/- 1 mg	05
3.	Wheel Speed Calibration Assembly	02
4.	Speedometer Tutor Analog	05
5.	Speedometer Tutor Digital	05
6.	Sin Bar, Bevel Protacto meter, slip gauges, linkage pantograph , vernier calipers(both digital & analog),	05 each

	Micrometers, spherometer, strain gauge	
7.	Surface Profilograph +/- 0.01 mm.	02
8.	Tachometer (Contact Type) Digital 3000 RPM	03
9.	Tachometer (Contact Type) Analog 3000 RPM	03
10.	Tachometer (Non Contact Type) Digital 3000 RPM	03
11.	Tachometer (Non Contact Type) Analog 3000 RPM	03
12.	Stroboscope	05
13.	Glass pieces, Lenses, Metallic Cylinder	05 each

## **2. Digital Electronics & Micro Processor Lab.**

<b>Sr. No</b>	<b>Description of Item</b>	<b>Quantity</b>
1	Familiarization of ICs trainer (7400), (7402), (7432), (7486), (7408), (7404), (7483), (7485), (74157), (74151), (74138)	05
2	EX-OR AND EX-NOR Gates realization kit (Using NAND OR NOR Gates)	05
3	Realization of Truth Table for OR AND NAND Gates using NAND Gates and NOR Gate	05
4	8 bit digital multiplexer	05
5	1:8 line de-multiplexer	05
6	Multiplex two BCD numbers to seven segment display	05
7	Study of Flip Flop RS, D, J-K & T	05
8	3 bit asynchronous up-counter 3 bit synchronous down counter	05
9	Universal Shift Registers having SISO, SIPO, PIPO, PISO	05
10	Study of De-latch & D flip flop trainer	05
11	encoder/decoder trainer	05
12	Digital IC Testers	02
13	Digital Lab. With modules	05
14	Logic Probe	05
15	Logic Pulser	05
16	Pulse Generator upto (3MHz)	05
17	Digital Frequency Meter	05
18	Digital IC Programmer with software	05
19	Digital IC Power Supplies (+/- 5V/1A, +/-12V/1A/+15V, 1A)	05
20	8085 Microprocessor Kit	05
21	8086 Microprocessor Kit	05
22	Interfacing kit (stepper motor)	05
23	Interfacing kit (ADC/DAC)	05
24	PIC 16F XX series kit	05
25	8051 micro controller kit with software	05
26	Microprocessor/Microcontroller ICs burner kit	02
27	Interfaced Card for LCD	05

28	Interfacing Card for Stepper Motor	05
29	Interfacing Card for LED	05
30	Interfacing Card for seven segment display	05
31	Interfacing Card for 8255	05
32	Universal Programmer	02
33	EPROM Programmer	02
34	EPROM Eraser	02
35	ANALOG OSCILLOSCOPE Oscilloscope 30 MHz Dual Trace	05
36	POWER SCOPE DC-30 MHz	05
37	DIGITAL STORAGE OSCILLOSCOPE 50 MHz	05
38	DIGITAL MULTIMETER 4 & ½ Digits	05
39	DIGITAL MULTIMETER 3 & ½ Digits	05
40	FUNCTION GENERATOR 0.3 MHz to 3 MHz	05
41	LCR-Q Meter	05
42	DC regulated Power Supply (30 V/3A)	05
43	DC regulated Power Supply (30 V/5A)	05
44	DC regulated Power Supply (30 V/2A, 0 to +/- 15V/1A, 5V/5A)	05
45	Frequency Counter 0.1 Hz to 1 GHz	05
46	Pulse Generator 2Hz to 20 MHz	05
47	Sine Wave Generator 20 Hz to 20 MHz	05
48	Audio Frequency Oscillator	05
49	Distortion Meter 20 Hz to 20kHz	05
50	Milli OHM Meter 20mOhm to 20kOhm	05
51	Universal IC Tester, Digital IC upto 40 pins	05
52	Soldering / Desoldering Station	05
53	Soldering Iron	05
54	CRO Probes BNC To BNC, BNC to Crocodile, BNC with 1:10X, 1:100X	05 each
55	Wire Stripper	05
56	Steel Scale	05
57	Screw Driver Set	05
58	Combination Pliers	05
59	Crimping Tools	05
60	Electronic Tool Kit	05
61	ESD Wrist Strep	05
62	ESD Mats for Table	05
63	Vacuum Cleaner	01
64	Twizer	05
65	VARIAC Single Phase	01
66	Battery Charger 12V, 6V, 1.5V	01

67	Servo Voltage Stabilizer for Bench Supply Single Phase 220V/ 5KVA	01
68	Microcontroller IDE Software with Compiler, programmer and simulator facility. (Windows Xp Sp2 based.). Such as Keil or Resonance or equivalent should be capable of programming 8051/ 8031 and PIC16F877 microcontroller etc. (05 user license)	05
69	Microcontroller Assembly programming kit(Assembler based) To program 80C51based assembly having LCD display.	05
70	PC based Microcontroller kits and application modules within built programmer for programming capability.( The kit should be compatible with PC based Microcontroller IDE Software and should have RS232 /USB2.0 interface and necessary driver or IDE software for Window Xp Sp2 based Microcontroller Kits.80C51 provided.) , RS232, 12Mhz Xtl, 9600bps, Ascii Keyboard, LCD display to be provided, printer.	05
71	PC based Microcontroller kits.(Built in Programmer)for PIC16F877 based.4mHz (05 user license)	05
72	Interfacing application module for Microcontroller 80C51 based. 6.1-LCD display Interface Module 6.2 -A/D Converter and LCD based result Module. 6.3 -D/A Converter and LCD based result module. 6.4 -Serial Data Transmission module from Kit to PC. 6.5 -Microcontroller based GSM module. 6.6-Interfacing various sensor module(temp, strain gauze etc)	05 each module
73	Desktop Computer System with Pentium IV or equivalent Processor. -Monitor LCD based. -Speaker and headphone. -2GB DDR 2 Ram(800mhz), expandable up to 4 GB -128MB dedicated Graphic memory. -optical mouse,,Multimedia keyboard,320GBSerial ATA II hard drive,USB port four 2.0, Optical drive 16x SuperMulti with lightScribe, Double layer(8.5GB) (05 user license)	05
74	Window Xp SP2 Operating system(05 user license)	05
75	Online UPS system with half hour back up. - 3 KVA with Half hour backup using SMF batteries on full load with cover enclosure for batteries. - 20Khz PWM IGBT - Low noise level	01

	- Compact size	
76	Computer Printer OfficeJet type. Duty cycle 5000 sides of pages Paper A4 210x297 mm A5 148x210mm B5 182x257mm Capacity : 250 sheets	01

### **3. Electrical & Electronics Measurement Lab.**

<b>Sr. No.</b>	<b>Description of Item</b>	<b>Quantity</b>
1	DIGITAL MULTIMETER 4 & ½ Digits	05
2	DIGITAL MULTIMETER 3 & ½ Digits	05
3	Analog Multi meter	05
4	Volt Meter (0-30V)	05
5	Ammeter (0-30A)	05
6	Watt Meter Single Phase /Three Phase	03 each
7	Power Factor Meter	05
8	Galvano Meter	05
9	LCR Meter	05
10	ANALOG OSCILLOSCOPE Oscilloscope 30 MHz Dual Trace	05
11	POWER SCOPE DC-30 MHz	05
12	DIGITAL STORAGE OSCILLOSCOPE 50 MHz	05
13	Dynamo Meter Type Frequency Meter	05
14	Megger	05
15	Earth Tester	05
16	Clamp Meter	05
17	Synchro scope	05
18	Current Transformer	05
19	Potential Transformer	05
20	Rheostat (10 to 100 Megaohm)	05
21	Magnetic Amplifier	05
22	Variac (Single Phase)	05
23	Transformer (3V/6V/9V/12V/15V/18V)	05 each
24	Energy Meter (Single Phase/Three Phase)	02 each
25	Panel Meters	05
26	Single Phase Load	05
27	Three Phase Load	05
28	Single Phase Motor (AC)	02

29	Three Phase Motor (AC)	02
30	Starters (Direct Online) , Auto Transformer	02
31	Synchronous Motor	02
32	Stepper Motor	02
33	Servo Motor	02
34	Induction Motor (1Hp)	02
35	Recorders (X-Y, Strip Chart, Circular chart)	02 each
36	Integrator Tutor Kit	05
37	Tutor for time response of First & Second Order System	05
38	Tutor for time response of First Order Temperature System	05
39	Tutor for time response of First Order flow System	05
40	Tutor for time response of First Order pressure System	05
41	Demonstrator Kit for open & closed loop process	05
42	PID trainer kit Proportional Integral Derivative	05
43	PLC setup with software (Allen Bradley/Any others)	02
44	Tutor for strain gauge	05
45	Tutor for Synchro transmitter and received kit	05
46	Piezo Electric Pressure Measurement kit	05
47	Temperature Measurement Kit Using RTD	05
48	Temperature Measurement Kit Using Thermocouple	05
49	Temperature Measurement Kit Using Thermistor	05
50	Level Measurement Kit Using Variable Capacitor Transducer	05
51	Kit for realization of photo transistor characteristics	05
52	Calibration Kit for LVDT	05
53	Vibration Measurement Tutor	05
54	Pyro Meter (Radiation Type)	02
55	Pyro Meter (optical Type)	02
56	555 trainer kit	05
57	Analog CRO	02
58	Instrumentation Amplifier Tutor Kit	10
59	Frequency Generator	05
60	Distortion Analyzer	05
61	Kit for Verification and realization of basic AC/DC bridges	05
62	Curve Tracer	05
63	Kit for Analog Lab with different modules (BJT/FET/MOSFET/Semi conductor devices)	05
64	Kit for realization of opamp (741) circuits	05
65	Kit for verification of potential meter loading effect characteristics	05
66	Calibration Kit Bimetallic Thermometer	05
67	Kit for level Limit Switch	05
68	Process Control Demonstration Kit for Temperature/Pressure/Level/Flow	02
69	Calibration kit for rotameter	05

70	Kit for DP Transmitter Characteristics	05
71	Working Model of turbine flow meter and electromagnetic target flow meter	05
72	Tutor for determination of time constant and reading time of thermocouple/RTD	05
73	Calibration Kit dead wt. tester	05
74	Wet Bulb & Dry Bulb Hygrometer	05
75	Moisture Meter Tutor	05
76	Tutor for coefficient of discharge of venturi meter	05
77	Pressure to current convertor	05
78	Current to pressure convertor	05
79	Kit Based on various methods to measure temperature	05
80	Kit Based on various methods to measure pressure	05
81	Kit Based on various methods to measure flow	05
82	Kit Based on various methods to measure level	05

#### 4. Opto & Analytical Electronics Lab.

Sr. No.	Description of Item	Quantity
1	Filter Photometer	05
2	Flame Photometer	05
3	Densitometer	05
4	Spectro photometer (Visible/infrared)	02 each
5	Single Beam Spectro photometer (Ultraviolet/Visual)	03 each
6	Double Beam Spectro photometer (Ultraviolet/Visual)	03 each
7	Mass Spectrometer	05
8	Liquid Chromatograph	05
9	Nuclear Magnetic resonance Spectrometer	05
10	ESR Spectrometer	05
11	Atomic Absorption Spectrometer	05
12	Demonstration Kit Based on Nuclear radiation measurement techniques	02

#### 5. Instrumentation Design Lab.

Sr. No.	Description of Item	Quantity
1	ANALOG OSCILLOSCOPE: Oscilloscope 30 MHz Dual Trace	05
2	POWER SCOPE DC-30 MHz	05
3	DIGITAL STORAGE OSCILLOSCOPE 50 MHz	05
4	DIGITAL MULTIMETER 4 & ½ Digits	05
5	DIGITAL MULTIMETER 3 & ½ Digits	05

6	FUNCTION GENERATOR 0.3 MHz to 3 MHz	05
7	LCR-Q Meter	05
8	DC variable regulated Power Supply (0-30/2A) dual	05
9	DC regulated Power Supply (30 V/5A)	05
10	DC regulated Power Supply (30 V/2A, 0 to +/- 15V/1A, 5V/5A)	05
11	Frequency Counter 0.1 Hz to 1 GHz	05
12	Pulse Generator 2Hz to 20 MHz	05
13	Sine Wave Generator 20 Hz to 20 MHz	05
14	Audio Frequency Oscillator	05
15	Distortion Meter 20 Hz to 20kHz	05
16	Milli OHM Meter 20mOhm to 20kOhm	05
17	Universal IC Tester, Digital IC upto 40 pins	05
18	Soldering / Desoldering Station	05
19	Soldering Iron	05
20	CRO Probes BNC To BNC, BNC to Crocodile, BNC with 1:10X, 1:100X	05 each
21	Wire Stripper	05
22	Steel Scale	05
23	Screw Driver Set	05
24	Combination Pliers	05
25	Crimping Tools	05
26	Electronic Tool Kit	05
27	Thermo Meter	05
28	ESD Wrist Strep	05
29	ESD Mats for Table	05
30	Vacuum Cleaner	01
31	Twizer	05
32	VARIAC Single Phase	01
33	Battery Charger 12V, 6V, 1.5V	01
34	Servo Voltage Stabilizer for Bench Supply Single Phase 220V/ 5KVA	01
35	Bread Board	10
36	Extension Board	05
37	Computers with Pentium P4 range having Window XP loaded	05
38	Circuits Maker Software	02
39	Orcad Software (Two User License)	02
40	Eagle Software for PCB(Three User License)	03
41	Printed Circuits Board (Single /Double Layer) Lab.	01
42	Power Drill Machine Hand held Type with bits	02
43	Hammer (Ball Point)	05
44	Marking Bit	05



## 6. Bio Medical Instrumentation Lab.

Sr. No.	Description of Item	Quantity
1	Demonstrating Model for Parts of human body	04
2	Incubator	02
3	Pulse Monitor Kit	04
4	Blood Pressure Measurement Kit (Sphygmomanometer)	04
5	ECG Machine with leads and recorder	01
6	Ultrasound Machine	01
7	Clinic Analyzer Kit	01
8	Centrifuge Machine	01
9	Stethoscope	04
10	Pacemaker Model	04
11	De-Fibrillator	01
12	Blood Gas Analyzer Kit	01
13	X-Ray Machine	01

## 7. Process Control Lab.

Sr. No	Description of Item	Quantity
1	Flapper Nozzle Assembly Kit	05
2	Lockup relay tutor	05
3	Hydraulic Amplifier Tutor	05
4	Electro pneumatic convertor and relay	05
5	Demonstrating Model of Different Valves (Diaphragm/Solenoid/Hand wheel etc.)	05
6	Control Valve with and without positioner kit	05
7	Model of Tank Level Control	02
8	Model of Boiler for Temperature Control	02
9	Model of Pressure Control	02
10	Model Based on Multi Loop Control System (Feed Forward /Cascading /Ratio)	02
11	Controller Actuator Assembly Kit	05
12	Transducer and Instrumentation Combined Trainer Kit	02
13	PLC Training Kit with static application modules & software. PLC ( Allen Bradley / LG / Reputed Make) 12 digital inputs and 8 digital outputs, 24VDC, 2Kstep (EEPROM), 0.4μsec per instruction, RS 232, RS 485 protocol for communication with PC. Supply voltage –110/220VAC. 2 analog inputs and 1 analog output, 0-10VDC/4-20mA jumper settable with 10 bit resolution with Rack mounted panels. Converter cum distribution panel for digital inputs and digital	02

	<p>outputs: All digital I/Os are brought out on experiment panel for easy connection.</p> <p>Converter cum distribution panel for analog inputs and outputs: All digital I/Os are brought out on experiment panel for easy connection.</p> <p>Simulation + extension panel for digital inputs, analog inputs and analog outputs. Provided with 4 nos. of switches and 4 nos. of push buttons for digital inputs. 6 nos. of potentiometer for analog inputs and 2 nos. of extension for analog output connection should provide.</p> <p>Simulation + extension panel for digital outputs with status LED indication.</p> <p>Should mounted on replaceable panel in sturdy "Aluminum Rack" with IOs brought out on 4mm banana socket on converter cum distribution panel while simulation cum extension panel provides necessary switches lamps, pots etc.</p> <p>Software Requirement : KGLWIN supports ladder diagram &amp; instruction set .</p> <p>Static Application Modules:-</p> <ol style="list-style-type: none"> <li>1 Bottle Filling System</li> <li>2 Drill Machine Control</li> <li>3 Material Handling</li> <li>4 Elevator</li> <li>5 Oven Control</li> <li>6 Stirred Tank Reactor</li> <li>7 Motor Starting and Dynamic Breaking Control</li> </ol>	
--	--	--

## 8. Communication Lab.

Sr. No.	Description of Item	Quantity
1	Amplitude Modulation and Demodulation trainer board.	05
2	Frequency modulation transmitter kit	05
3	Frequency demodulation received kit	05
4	FDM transmitter /receiver kit	05
5	Analog Signal sampling and reconstruction kit	05
6	TDM Pulse code modulation kit	05
7	TDM pulse demodulation kit	05
8	PAM/PWM/PPM modulation/demodulation kit	05
9	PCM modulation & demodulation trainer	05
10	Communication Simulation Software	01
11	Fiber Optics Communication trainer kit	05
12	OFC source, detector & connector assembly units	05
13	Output Power Watt Meter	05
14	Standard AM/FM Signal Generator	05
15	RF Signal Generator	02

16	Spectrum Analyzer	05
17	Data Communication Trainer Kit	05
18	ASK/FSK Modulation/Demodulation Trainer Kit	05
19	Hamming Code Tx /Rx Trainer Kit (Serial Link)	05
20	USART trainer kit (To transmit parallel data on serial link)	05
21	Modem. Trainer	05
22	TDM trainer	05
23	RS 232 interface kit	05
24	Audio Oscillator	05
25	Delta Modulation/Demodulation Trainer Kit	03
26	ANALOG OSCILLOSCOPE Oscilloscope 30 MHz Dual Trace	05
27	POWER SCOPE DC-30 MHz	05
28	DIGITAL STORAGE OSCILLOSCOPE 50 MHz	05
29	DIGITAL MULTIMETER 4 & ½ Digits	05
30	DIGITAL MULTIMETER 3 & ½ Digits	05
31	FUNCTION GENERATOR 0.3 MHz to 3 MHz	05
32	LCR-Q Meter	05
33	DC variable regulated Power Supply (0-30/2A) dual	05
34	DC regulated Power Supply (30 V/5A)	05
35	DC regulated Power Supply (30 V/2A, 0 to +/- 15V/1A, 5V/5A)	05
36	Frequency Counter 0.1 Hz to 1 GHz	05
37	Pulse Generator 2Hz to 20 MHz	05
38	Sine Wave Generator 20 Hz to 20 MHz	05
39	Audio Frequency Oscillator	05
40	Distortion Meter 20 Hz to 20kHz	05
41	Milli OHM Meter 20mOhm to 20kOhm	05
42	Demonstration Kit on Transmitter and receiver used in communication	05
43	Demonstrator LAN/MAN/WAN	03
44	Demonstrator CDMA/GSM	03
45	DSP Trainer Kit with Software	01
46	Dual Tone Multi frequency demonstrator kit	01
47	Speech Processing /Image Processing Tutor kit	01
48	Model for remote control base system	02
49	remote sensors and detectors kit	02
50	Aerial Photography camera	01
51	Scanner	01
52	Model of Satellite (Demonstrator)	01
53	Tutor on Radar/Sonar/Slar	01 each

**9 Industrial Electronics Lab.**

<b>Sr. No.</b>	<b>Description of Item</b>	<b>Quantity</b>
1	Dual Trace CRO 30 MHz	05
2	UJT&UJT Relaxation oscillator kit	05
3	SCR & Phase Control Trainer Kit	05
4	dv/dt Limitation of SCR kit	05
5	Triac & AC Phase Control Kit	05
6	Universal Motor Speed Control Kit	05
7	Thyristor Application kit (Over voltage protection/battery charger /voltage regulator/alarm circuits/time delay relay circuit/over current protection)	02 each
8	SCR DC Circuits Breaker kit	05
9	Universal Motor Speed Control with Power Supply	05
10	Diac Trainer kit	05
11	Single Phase Half Wave Control Rectifier Using SCR Board	05
12	Single Phase Full Wave Control Rectifier Using SCR Board	05
13	Single Phase Full wave bridge control rectifier board	05
14	Board to study VI characteristic of SCR/TRIAC	05 each
15	Board based on induction/ dielectric heating	02 each
16	Series Inverter	02
17	Parallel Inverter	02
18	Demonstration Model on Thyristor Family	02
19	Demonstration Model on various type of heat sink	02
20	TRIC Based Lamp intensity & AC Fan Speed Control Trainer Board	05
21	Digital AC / DC Clamp Current Meter	05
22	Power Electronics Trainer kit	05
23	Bread Board	10
24	Logic Probe	05
25	Logic Pulser	05
26	ANALOG OSCILLOSCOPE: Oscilloscope 30 MHz Dual Trace	05
27	POWER SCOPE DC-30 MHz	05
28	DIGITAL STORAGE OSCILLOSCOPE 50 MHz	05
29	DIGITAL MULTIMETER 4 & ½ Digits	05
30	DIGITAL MULTIMETER 3 & ½ Digits	05
31	FUNCTION GENERATOR 0.3 MHz to 3 MHz	05
32	LCR-Q Meter	05
33	DC regulated Power Supply (30 V/3A)	05
34	DC regulated Power Supply (30 V/5A)	05
35	DC regulated Power Supply (30 V/2A, 0 to +/- 15V/1A, 5V/5A)	05

**11.1.2 Space Requirement:**

Norms and standards laid down by All India Council for Technical Education (AICTE) may 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.

**11.1.3 Furniture Requirement**

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

**11.2 Human Resources Requirement:**

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.