10. RESOURCE REQUIREMENT

10.1 PHYSICAL RESOURCES

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.

10.1.2 Equipment requirement:

Following Laboratories are required for Diploma Programme in Electronics and Communication Engineering:

1. Measurement Laboratory
2. Electrical Engineering Laboratory
3. Microwave Engineering Laboratory
4. Television Engineering Laboratory
5. Communication System Laboratory - I
6. Communication System Laboratory – II (Advanced)
7. Industrial Electronics Laboratory
8. Control System Laboratory
9. Microprocessor Laboratory 8085, 8086 (Demo Kit)
10. Electronics Devices & Circuits and Network Laboratory
11. Digital Electronics and Digital Circuits Laboratory
12. Analog Integrated Circuits
13. Digital Signal Processing Laboratory
14. Electronics and Instrumentation Laboratory

Note: Some of the laboratories can be clubbed keeping in mind best utilisation of space and equipment, the above mentioned 14 laboratories after clubbing reduce to 8 laboratories which are given below:

EQUIPMENT REQUIRED FOR ELECTRONICS (SPL. POWER ELECTRONICS)

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs)
1.	**ELECTRONICS LABORATORY**		
1.	DC regulated low voltage variable power supply	10,	25,000
2.	DC regulated multiple output power supply	4	12,000
3.	Audio oscillator	4	16,000
4.	Wide band RC Oscillator	4	10,000
5.	RF Signal Generator	2	8,000
6.	Pulse Generator	2	10,000
7.	Function Generator	4	20,000
8.	Single trace CRO with accessories	4	60,000
9.	Dual trace CRO with accessories	4	1,00,000
10.	Electronic Multimeter DC and AC with different ranges	8	30,000
11.	Electronics digital Multimeter three and a half digit	8	25,000
12.	Digital LCR- Q meter	2	20,000
13.	Transistor tester type 911	1	5,000
14.	Audio output power meter	2	6,000
15.	Mains Voltage stabilizer(3 KVA)	1	10,000
16.	AC Millivoltmeters	4	16,000
17.	DC Millivoltmeters	2	6,000
18.	Voltmeter	5	3,000
19.	DC Ammeter	5	3,000
20.	Battery of different voltage and Ampere hour	2	3,000
21.	Single Phase variac	3	6,000
22.	Rheostat of different wattage and resistance	5	3,000
23.	Servo stabilizer power supply	1	8,000
24.	IC Bread Boards	20	10,000
25.	Distortion factor meter	1	10,000
26.	Decade resistance, capacitance and inductance (four each)	12	12,000
27.	Transducers: Pressure type, thermocouple, LVDT, opto Pick-up, electromagnetic pick-up, ultrasonic pick-up and potentiometer etc	LS	30,000
28.	Thyristor control experimental kits Instrumentation/Transducer experimental kit. Basic electronic experiment kit	LS	2,50,000
29.	Strip chart recorder	1	10,000
30.	Digital Panel meters	6	3,000
31.	Digital thermometer	1	4,000
32.	Stroboscope cum motor drive disc	1	10,000
33.	Digital load indicator with load Cells	1	10,000
34.	Digital Lux meter	1	8,000
35	CROs 20 MHz (Scientific Make)	6 Nos.	22,000
36	Function Generators Audio Frequency	6 Nos.	7,500
37	Regulated Power Supply	6 Nos.	3,600

Sr. No.	Detail of Instrument	Qty.	Per Unit Cost (in Rs)
38	Multimeter (Digital)	10 Nos.	2,000
39	Rectifier Kits	6 Nos.	2,200
40	Filter Circuit Kit	6 Nos.	2,200
41	Bread Boards	12 Nos.	2,800
42	Transistor Kits (a) CB (b) CE	 6 Nos. 6 Nos.	 2,400 2,400
43	FETs	6 Nos.	2,400
44.	Operational Amplifier Kits	6 Nos.	3,000
45.	Raw Materials	LS	20,000

2. BASIC COMMUNICATION ENGINEERING LABORATORY

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs)
1.	DC regulated low voltage variable Power Supply	6	12,000
2.	*RF Signal Generator	3	15,000
3.	Electronic Multimeter with different voltage ranges	6	22,000
4.	Electronic Digital Multimeter	6	20,000
5.	Standard Signal Generator	2	50,000
6.	Facsimile(Fax)-transmitter receiver	1	20,000
7.	Radio Receiver Trainer Kits/Deconstruction Models	LS	10,000
8.	AM/FM signal generator	2	20,000
9.	Super heterodyne Receiver radio Demonstration model	1	4,000
10.	Communication receiver	1	5,000
11.	Optical fibre bench	1	25,000
13.	CRO 25 MHz	3	80,000
14.	Digital frequency meter	1	10,000
15.	50 MHz CRO	1	50,000
16.	Modems, opto coupler different types of microphones and other accessories	LS	10,000
17.	Advanced Communication Trainer	LS	1,00,000
18.	EPFAX, 56 lines including	LS	60,000
19.	Cellular Mobile Kit, Pager etc	2 each	10,000
20.	Pulse Modulation and Demodulation	6	20,000
21.	Pulse Amplitude Modulation and Demodulation	6	18,000
22.	Pulse Width Modulation and Demodulation	6	18,000
23.	Data Formatting and Carrier Modulation Transistor Trainer Model (ST 2106)	6	25,000
24	Carrier Demodulation of Data Reformatting Receiver Trainer Kit (ST 12107)	6	25,000

Sr. No.	Detail of Instrument	Qty.	Per Unit Cost (in Rs)
25.	Audio Input Module Trainer Model (ST 2108)	6	12,000
26.	Audio Output Model Trainer Model (ST 2109)	6	8,000
27.	AM Transmitter Trainer Model (ST 2201) Scientech	6	20,000
28.	AM Receiver Trainer Model (ST 2202) Scientech	6	20,000
29..	FM Communication Trainer Model (ST 2203) Scientech	6	25,000
30.	Sampling Reconstruction Trainer (ST 2101)	6	11,000
31.	Pulse Code Modulation Transmitter (ST 2103)	6	25,000
32.	Pulse Code Modulation Receiver (ST 2104)	6	25,000
33	Delta Adaptive Delta Sigma Modulation and Demodulation Trainer (ST 2105)	6	30,000
3.	**ELECTRONICS WORKSHOP**		
1.	Hand Tools Set	5	5,000
2.	Soldering Set'	5,	5,000
3.	Hand Drill	1	3,000
4.	PCB Etching Machine	2	2,500
5.	Silk Screen Printing	2 set	50,000
6.	Drafting Equipment	1 set	15,000
7.	PCB Drilling Machine	1	10,000
8.	Sheet metal folding and binding machine	1	20,000
9.	Sheet metal cutting machine	1	5,000
10.	Centre Lathe	1	15,000
11.	Grinder	1	6,000
12.	Circular saw	1	6,000
13.	*DC regulated low voltage variable power supply	2	12,000
14.	*Audio Oscillator	2	6,000
15.	*RF Signal generator	2	8,000
16.	*Digital LCR-Q meter	1	10,000
17.	*Digital multi-meter	4	12,000
18.	*Single trace CRO	2	25,000
19.	*AC Milivoltmeter	1	3,500
20.	IC Bread boards	6	3,000
21.	Soldering stations temperature controlled	7	10,500
22.	Solder suckers with accessories	10	500
4.	**DIGITAL ELECTRONICS AND MICROPROCESSORS LABORATORY**		
1.	*DC regulated low voltage variable power supply	6	15,000
2.	*DC regulated multiple output power supply	3	9,000
3.	Digital IC power supply	8	10,000
4.	*Electronic Digital Multimeter	6	9,000
5.	CRO Dual trace, 25 MHz	4	1,00,000

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs)
6.	*Digital frequency meter/universal Counter timer	2	20,000
7.	*Pulse Generator	2	10,000
8.	Logic probes (TTL and CMOS)	2	2,500
9.	Digital logic trainer (TTL)	4	20,000
10.	Logic Trainer Boards	10	10,000
11.	Microprocessor trainer Kits 8085	8	50,000
12.	Microprocessor Trainer Kits 8086	6	60,000
13.	Microprocessor Trainer Kits 8051/8031	5	30,000
14.	Computer Trainer	1	30,000
.			**Rate per Unit**
15.	8085 Micro processor Kit (Vinytics)	15	
16.	9086 Micro processor Kit (Dynalog)	15	2,500
17.	Interfacing Cards	5	2,50,000
18.	Micro-controller Kit 8051 based (Dyna-51)	10	1,00,000
19.	Digital IC Tester Model - Nikki	1 No.	50,000
20.	Universal Programmer	1 No.	7,000
21.	Digital Multimeter (Motwane)	10 No.	60,000
22.	EPROM Programme	1	10,000
23.	EPROM Eraser	1	1,500
24.	Additional cards	LS	50,000
25.	Software	LS	1,50,000
26.	Dotmatrix Printers 24 pin 132 col	2	15,000
27.	Ink jet Printers	2	6,000
5.	**MEASUREMENT LABORATORY**		
1.	Light Measurement (Photocells) Kit	8 Nos.	15,000
2.	LVDT Kit	8 Nos.	8,000
3.	Pressure Measurement Kit	8 Nos.	9,500
4.	Strain Measurement Kit	8 Nos.	14,000
5.	Water Level Measurement Kit	8 Nos.	11,500
6.	Velocity Measurement Kit	8 Nos.	7,500
7.	RPM Measurement Kit	8 Nos.	5,000
8.	Temperature Measurement Kit	8 Nos.	5,000
9.	Maxwell's Bridge Kit	8 Nos.	7,500
10.	Wein's Bridge Kit	8 Nos.	4,500
11.	Anderson Bridge Kit	8 Nos.	5,000

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs)
12.	Flux Meter (Digital) Kit	8 Nos.	5,000
13.	Q. Meter (Digital) Kit	8 Nos.	5,000
6.	**ELECTRICAL ENGINEERING LABORATORY**		
1.	Ammeter, Voltmeter, Wattmeter and Energy Meters (3- phase and 1- phase)	8 each	40,000
2.	3-Phase Resistive load	4 Nos.	16,000
3.	LCR/Q Bridge	1	5,000
4.	Tong tester	4	12,000
5.	Transformer (single phase)	2	16,000
6.	Watt meter, Volt meter, Ammeter,	2 each	10,000
7.	DC Shunt Motor,2 hp with loading arrangement	1	20,000
8.	Induction Motor (Single phase)	2	10,000
9.	Induction Motor (Three phase)	2	10,000
10.	Slipring Induction Motor 3 HP with loading facility	1	25,000
11.	Alternator and Load for Alternators	1	25,000
12.	DC generator with prime-mover motor	2	25,000
13.	DC Regulated Power Supply	2	6,000
14.	Starters (DOL and Star Delta)	2 each	8,000
15.	Rheostats	4	12,000
16.	Tacho meters (digital)	2	15,000
17.	Maggar (Insulation Tester)	2	5,000
18.	Earth Tester	2	10,000
19.	Digital Multi-meter	10	32,000
20.	Rectifier, Inverter Set	1	10,000
7.	**INDUSTRIAL ELECTRONICS LABORATORY**		
1.	Morgan Chopper Kit	6 Nos.	5,000
2.	Joner Chopper	6 Nos.	5,000
3.	Series Inverter	6 Nos.	8,000
4.	Parallel Inverter	6 Nos.	8,000
5.	Speed Control of dc motor (Thyristorized)	6 Nos.	5,000
6.	Single Phase Cyclo Convertor with Thyristors	6 Nos.	20,000
7.	Kit for study of effect of free wheeling diode on power factor	6 Nos.	5,000
8.	SCR Characteristics	6 Nos.	1,500
9.	Gate Triggering Characteristics of SCR	6 Nos.	10,000
10.	AC Phase Control Trainer Kit	6 Nos.	6,000
11.	Kit to Study 3-phase Control Bridge Convertor	6 Nos.	17,500
12.	UJT Characteristics and its Application as Relaxation Oscillator	6 Nos.	1,500

Sr. No.	Detail of Instrument	Qty.	Approximate Cost (in Rs)
8.	**CONTROL SYSTEM LABORATORY**		
1	Proportional Integral Derivation (PID) Controller Kit	5 Nos.	12,000
2.	DC Motor Position Control System Kit	5 Nos.	18,000
3.	Potentiometer Error detector Kit	5 Nos.	7,500
4.	Stepper Motor with Microprocessor Interface Kit	5 Nos.	17,000
5.	Synchro Transmitter Kit	5 Nos.	15,000
6.	Synchro Control Transformer Kit	5 Nos.	9,000
7.	Speed Torque Characteristics of AC Servomotor Kit	5 Nos.	15,000
8.	Compensating Circuits including lead, lag transient and frequency response of second order system Kit	5 Nos.	15,000

NOTE:

In addition to the above, laboratories in respect of physics, chemistry, applied mechanics, strength of materials, general engineering, workshops, Computer Centre etc will be required for effective implementation of the course. Provision for overhead projectors, TV with VCR facility, slide cum strip projector, photocopiers, PC-XT facilities along with LCD Projection System, 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.

10.2 Human Resources Development:

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

11. EVALUATION STRATEGY

11.1 INTRODUCTION

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learning endeavor is to ensure the quality of the product which can be assessed through learner's evaluation.

The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students.

Evaluation is of two types: Formative and Summative (Internal and External Evaluation)

Formative Evaluation

It is an on-going evaluation process. Its purpose is to provide continuous and comprehensive feedback to students and teachers concerning teaching-learning process. It provides corrective steps to be taken to account for curricular as well as co-curricular aspects.

Summative Evaluation

It is carried out at the end of a unit of instruction like topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and systematic manner since any mistake or lacuna is likely to affect the future of students.

In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative evaluation with a view to bring validity and reliability in the end-term examination system for achieving objectivity and efficiency in evaluation.

11.2 STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

- Theory
- Practical Work (Laboratory, Workshop, Field Exercises)
- Project Work
- Professional Industrial Training

11.2.1 Theory

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve problems. The formative evaluation for theory subjects may be caused through sessional/class-tests, home-assignments, tutorial-work, seminars, and group discussions etc. For end-term evaluation of theory, the question paper may comprise of three sections.

Section-I

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-1 should be of the order of 20 percent of the total marks and no choice should be given in this section. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at the most application domains only.

Section-II

It should contain short answer/completion items. The weightage to this section should be of the order of 40 percent of the total marks. Again, no choice should be given in section-II

Section-III

It may contain two to three essay type questions. Total weightage to this section should be of the order of 40 percent of the total marks. Some built-in, internal choice of about 50 percent of the questions set, can be given in this section

Table II : Suggested Weightage to be given to different ability levels

Abilities	Weightage to be assigned
Knowledge	10-30 percent
Comprehension	40-60 percent
Application	20-30 percent
Higher than application i.e. Analysis, Synthesis and Evaluation	Upto 10 percent

11.2.2 Practical Work

Evaluation of students performance in practical work (Laboratory experiments, Workshop practicals/field exercises) aims at assessing students ability to apply or practice learnt concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work related

attitudes. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behaviour and it should be followed by viva-voce.

11.2.3 Project Work

The purpose of evaluation of project work is to assess students ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The formative and summative evaluation may comprise of weightage to nature of project, quality of product, quality of report and quality of presentation followed by viva-voce.

11.2.4 Professional Industrial Training

Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of materials, industrial processes, practices in the industry/field and their ability to engage in activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. The formative and summative evaluation may comprise of weightages to performance in testing, general behaviour, quality of report and presentation during viva-voce.

11.3 ASPECTS OF QUESTION PAPER SETTING

Validity and reliability are the most important considerations in the selection and construction of evaluation procedures. First and foremost are the evaluation tools to measure the specific outcomes for which they are intended to measure. Next in importance is reliability, and following that is a host of practical features that can be classified under the heading of usability.

For weightage of marks assigned to formative (internal) and summative (external) evaluation and duration of evaluation has been given in the study and evaluation scheme of the curriculum document. Teachers/Paper-setters/Examiners may use Manual for Students' Evaluation developed by National Institute of Technical Teachers' Training & Research, Sector-26, Chandigarh to bring objectivity in the evaluation system. The working group found it very difficult to detail out precisely the contents of subject on **languages** and therefore teachers may send guidelines to respective examiners for paper setting to maintain objectivity in evaluation.

12. RECOMMENDATIONS FOR EFFECTIVE IMPLEMENTATION OF CURRICULUM

The following recommendations are made for effective implementation of this curriculum.

a) While imparting instructions, stress should be laid on the development of practical skills in the students.

b) Field visits be organized as and when required to clarify the concepts, principles and practices involved. For this purpose, time has already been provided in student centred activities

c) Extension lectures from professionals should be organised to impart instructions in specialised areas

d) There is no need of purchasing very costly equipment. Efforts may be made to establish linkages with local industries/field organizations

e) Considerable stress should be laid on personality development of the student, which is very essential for any diploma holder

f) Teachers should generate competitiveness among the students for the development of professional skills.

g) Teachers should take interest in establishing linkages with industries and field organizations for imparting field experiences to their students

h) Hobby clubs and other co-curricular activities be promoted to develop creativity in the students

i) Teachers should be sent for training in the new areas relevant to their field of specialization

j) Students should be given relevant and well thought out project assignments. This will help students in developing creativity and confidence in them for gainful employment (wage and self)

k) A **project bank** should be developed by the **Electronics Engineering (Spl. In Power Electronics)** department of the polytechnic in consultation with other related institutions in the state.