6.1 UTILIZATION OF ELECTRICAL ENERGY

L T P

Periods /week 6 - 3

RATIONALE

This subject assumes importance in view of the fact that an electrical technician has to work in a wide spectrum of activities wherein he has to make selection from alternative schemes making technical and economical considerations; e.g. to plan and design an electrical layout using basic principles and handbooks, to select equipment, processes and components in different situations. The contents have been designed keeping the above objectives in view. Besides giving him basic knowledge in the topics concerned, attempts have been made to ensure that the knowledge acquired is applied in various fields as per his job requirements. To orient the subject matter in the proper direction, visits to industrial establishments are recommended in order to familiarize the students with the new developments in different areas

DETAILED CONTENTS

UNIT 1

Illumination: **(20 PERIODS)**

1.1 Nature of light, visibility spectrum curve of relative sensitivity of human eye and wave length of light.

1.2 Definition: Luminous flux, solid angle, luminous intensity, illumination, luminous efficiency, depreciation factor, coefficient of utilization, space to height ratio, reflection factor, glare, shadow, lux.

1.3 Laws of illumination – simple numerical.

1.4 Different type of lamps, construction and working of incandescent and discharge lamps – their characteristics, fittings required for filament lamp, mercury vapour sodium lamp, fluorescent lamp, halogen lamp, neon lamp, compact fluorescent lamp(CFL), LED Lamp, comparison of incandescent, fluorescent, CFL & LED.

1.5 Calculation of number of light points for interior illumination, calculation of illumination at different points, considerations involved in simple design problems. Illumination schemes,indoor and outdoor illumination levels.

1.6 Main requirements of proper lighting; absence of glare, contrast and shadow.

1.7 Awareness about time switches, street lighting, flood lighting, monument lighting and decorative lighting, light characteristics etc.

UNIT2.

Electric Heating AND Electric Welding **(20 PERIODS)**

2.1 Advantages of electrical heating

2.2 Heating methods:

2.2.1 Resistance heating – direct and indirect resistance heating, electric ovens, their temperature range, properties of resistance heating elements, domestic water heaters and other heating appliances, thermostat control circuit.

2.2.2 Induction heating; principle of core type and coreless induction furnace, their construction and applications.

2.2.3 Electric arc heating; direct and indirect arc heating, construction, working and applications of arc furnace.

2.2.4 Dielectric heating, applications in various industrial fields.

2.2.5 Infra-red heating and its applications (construction and working of two appliances).

2.2.6 Microwave heating and its applications (construction and working of two appliances).

2.2.7 Solar Heating.

2.3 Calculation of resistance heating elements (simple problems).

2.4 Advantages of electric welding

2.5 Welding method

2.6 Principles of resistance welding, types – spot, projection, seam and butt welding, welding equipment

2.7 Principle of arc production, electric arc welding, characteristics of arc; carbon arc, metal arc, hydrogen arc welding method and their applications. Power supply requirement, Advantages of using coated electrodes, comparison between AC and DC arc welding, welding control circuits, welding of aluminum and copper.

UNIT3 **(10 PERIODS)**

Electrolytic Processes

3.1 Need of electro-deposition

3.2 Laws of electrolysis, process of electro-deposition - clearing, operation, deposition of metals, polishing and buffing

3.3 Equipment and accessories for electroplating

3.4 Factors affecting electro-deposition

3.5 Principle of galvanizing and its applications

3.6 Principles of anodizing and its applications

3.7 Electroplating of non-conducting materials

3.8 Manufacture of chemicals by electrolytic process

3.9 Power supplies for electroplating

UNIT4. **(10 PERIODS)**

Electrical Circuits used in Refrigeration, Air Conditioning and Water Coolers

4.1 Principle of air conditioning, vapour pressure, refrigeration cycle, eco friendly refrigerants.

4.2 Description of Electrical circuit used in
a) Refrigerator,
b) Air-conditioner, and Water cooler

UNIT5. **(20 PERIODS)**

Electric Drive
5.1 Advantages of electric drives

5.2 Characteristics of different mechanical loads

5.3 Types of motors used as electric drive

5.4 Electric braking
5.4.1 Plugging
5.4.2 Rheostatic braking

5.4.3 Regenerative braking

5.5 General idea about the methods of power transfer by direct coupling by using devices like belt drive, gears, chain drives etc.

5.6 Examples of selection of motors for different types of domestic loads

5.7 Selection of drive for applications such as general workshop, textile mill, paper mill, steel mill, printing press, crane and lift etc. Application of flywheel.

5.8 Specifications of commonly used motors e.g. squirrel cage motors, slip ring induction motors, AC series motors, Fractional kilo Watt(FKW) motors

5.9 Selection of motors for Domestic Appliances

UNIT 6 **(16 PERIODS)**

6. Electric Traction:

6.1 Advantages of electric traction over other types of traction.

6.2 Different systems of electric traction, DC and AC systems, diesel electric system, types of services – urban, sub-urban, and main line and their speed-time curves

6.3 Different accessories for track electrification; such as overhead catenary wire, conductor rail system, current collector-pentagraph

6.4 Factors affecting scheduled speed

6.5 Electrical block diagram of an electric locomotive with description of various equipment and accessories used.

6.6 Types of motors used for electric traction

6.7 Power supply arrangements

6.8 Starting and braking of electric locomotives

6.9 Introduction to EMU and metro railways

6.10 Train Lighting Scheme

LISIT OF PRACTICALS

Students should be taken for
(1)visit to nearest electrified railway track and railway station
(2) visit to study the electric traction system
(3) industrial visit to study the electric installation in a building,
(4) visit to electrolysis process. They have to prepare report prepare a report. The evaluation of practical work will be made on the basis of report and presentation.

INSTRUCTIONAL STRATEGY

It is desired to give ample practical examples in the class while teaching this subject. Teacher must supplement his/her classroom teaching with aids such as models, charts, and video films from time to time. This subject requires demonstrations and exposure to actual workplace/industry/field. For this purpose, the subject teacher should do advance planning for visits/studies related to each topic in consultation with HOD and Principal of the polytechnic/institution.

RECOMMENDED BOOKS

1. Art and Science of Utilization of Electrical Energy by H Partap, Dhanpat Rai & Sons, Delhi
2. Utilization of Electrical Energy by JB Gupta, Kataria Publications, Ludhiana
3. Utilization of Electrical Energy by Sahdev, Uneek Publication, Jalandhar
4. A Text Book. of Electrical Power by Dr. SL Uppal, Khanna Publications, Delhi
5. Modern Electric Traction by H Partap, Dhanpat Rai & Sons, Delhi
6. Utilization of Electrical Energy by OS Taylor, Pitman Publications
7. Generation, Distribution and Utilization if Electrical Power by CL Wadhwa, Wiley Eastern Ltd., New DelhI

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (PERIODS)	Marks Allocation (%)
1	20	20
2	20	20
3	10	12
4	10	12
5	20	20
6	16	16
Total	96	100

6.2 NON- CONVENTIONAL ENERGY SOURCES

L T P

Periods 6 – 3

RATIONALE

Energy is a crucial input in the process of economic, social and industrial development. High energy consumption has traditionally been associated with higher quality of life, which in turn is related to Gross National Project (GNP). Since the conventional energy resources are under depletion, it is high time to tape the non conventional energy sources like solar and bio-energy. Uttarakhand is rich in hydro energy and lot of potential for self employment exists in setting up Micro Hydro plant. This subject is included to take care of special need of the state.

DETAILED CONTENTS

UNIT 1. Non-Conventional Sources of Energy : An overview (10 Periods)

Importance of Non conventional sources of energy, Present Scenario, Future Prospects, Economic Criteria. Types of non-conventional energy sources.

Unit 2. Solar Energy (10 Periods)

Physical Principal of the conversion of Solar radiation into heat, Photo-voltaic cell, Electricity generation, Solar water heaters, Solar Furnaces, Solar cookers, Solar Stills solar pumping.

Unit 3. Wind Energy (12 Periods)

Wind Energy Conversion, Wind mills, Electricity generation from wind- Types of wind mills, local control, energy storage 8. Geo-thermal and Tidal Energy (8 Periods) Geo-thermal sources, Ocean thermal electric conversion, open and closed cycles, hybrid cycles. Prime movers for geo-thermal energy conversion, Steam Generation and electricity generation.

.**Unit 4. Bio-energy (10 Periods)**

Bio-mass Conversion Technologies- wet and dry processes. Methods for obtaining energy from Biomass. Power Generation by using gasifiers.

Unit5. Geo-thermal and Tidal Energy (10 Periods)

Geo-thermal sources, Ocean thermal electric conversion, open and closed cycles, hybrid cycles. Prime movers for geo-thermal energy conversion. Steam Generation and electricity generation.

UNIT 6. Micro Hydel Plants **(30 Periods)**

Small and Micro Hydro Electric Power Plants: An Overview

- Advantages and Disadvantages of Small and Micro Hydro Schemes
- Layout of a Micro Hydro Scheme
- Main Elements of a Micro Hydro Plant
- Water turbines
- Turbine Classifications, Characteristics and Selection
- Generators
- Specifications of Turbine, Generator and Governor System used in Small and Micro
- Hydro Electric Power Plants
- Overview of Automation, Control and Monitoring of Micro Hydro Electric Power Plants
- Efficiency and Limitations.
- Erection and Commissioning, Operation and Maintenance of Micro Hydro Electric Power Plants

Unit 7. Chemical Energy Sources **(14 Periods)**

Design and operating principles of a fuel cell, conversion efficiency, work output and emf of fuel cells, applications storage battery characteristics, types, applications, maintenance of batteries.

Practical: Students should be taken to site of Micro Hydro Plant and Non Conventional Energy Sources units. They may be asked to prepare report of the visits and make presentation in the class.

RECOMMENDED BOOKS

1. Solar Energy – Principles of thermal collection and Storage SP Sukhatme, Tata McGraw Hill Publication, New Delhi.
2. Solar Energy Utilization; GD Rai; Khanna Publishers, New Delhi.
3. Reviews of Renewable Energy Sources, Vol. 3, Edited by MS. Sodha, S.S. Mathur, MAS Malik, TC Kandpal ; Wiley Eastern Limited, New Delhi.
4. Renewable Energy Sources and Conversion Technology by NK Bansal,Manfred Kleemann, Michael Meliss, Tata McGraw Hill Publishing Co. Ltd New Delhi.
5. Energy Today and Tomorrow; Maheshwar Dayal; Publications Division, Ministry of Information and Broadcasting, Govt. of India, New Delhi.
6. Energy Technology (non-conventional, renewable and conventional) by S Rao and BB Parulekar, Khanna Publishers, New Delhi
7. Non Conventional Energy Sources by B.H Khan, A tata McGraw Hill Publication New Delhi
8. Micro Hydel Design Manual by Adam Harvey, Intermediate technology Publication

Topic No.	Time Allotted	Marks Allocation

SUGGESTED DISTRIBUTION OF MARKS

	(PERIODS)	(%)
1	10	10
2	10	10
3	12	12
4	10	10
5	10	10
6.	30	32
7.	14	16
Total	96	100

6.2 NON- CONVENTIONAL ENERGY SOURCES

L T P

Periods 6 – 3

RATIONALE

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2. Solar Energy Utilization; GD Rai; Khanna Publishers, New Delhi.
3. Reviews of Renewable Energy Sources, Vol. 3, Edited by MS. Sodha, S.S. Mathur, MAS Malik, TC Kandpal ; Wiley Eastern Limited, New Delhi.
4. Renewable Energy Sources and Conversion Technology by NK Bansal,Manfred Kleemann, Michael Meliss, Tata McGraw Hill Publishing Co. Ltd New Delhi.
5. Energy Today and Tomorrow; Maheshwar Dayal; Publications Division, Ministry of Information and Broadcasting, Govt. of India, New Delhi.
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SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (PERIODS)	Marks Allocation (%)
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2	10	10
3	12	12
4	10	10
5	10	10
6.	30	32
7.	14	16
Total	96	100

6.2 NON- CONVENTIONAL ENERGY SOURCES

L T P

Periods 6 – 3

RATIONALE

Energy is a crucial input in the process of economic, social and industrial development. High energy consumption has traditionally been associated with higher quality of life, which in turn is related to Gross National Project (GNP). Since the conventional energy resources are under depletion, it is high time to tape the non conventional energy sources like solar and bio-energy. Uttarakhand is rich in hydro energy and lot of potential for self employment exists in setting up Micro Hydro plant. This subject is included to take care of special need of the state.

DETAILED CONTENTS

UNIT 1. Non-Conventional Sources of Energy : An overview **(10 Periods)**

energy, Criteria.

Importance of Non conventional sources of Present Scenario, Future Prospects, Economic Types of non-conventional energy sources.

Unit 2.

Solar Energy

(10 Periods)

Physical into heat, water Stills

Principal of the conversion of Solar radiation Photo-voltaic cell, Electricity generation, Solar heaters, Solar Furnaces, Solar cookers, Solar solar pumping.

Unit 3. Wind Energy **(12 Periods)**

Wind Energy Conversion, Wind mills, Electricity generation from wind- Types of wind mills, local control, energy storage 8. Geo-thermal and Tidal Energy (8 Periods) Geo-thermal sources, Ocean thermal electric conversion, open and closed cycles, hybrid cycles. Prime movers for geo-thermal energy conversion, Steam Generation and electricity generation.

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7. Non Conventional Energy Sources by B.H Khan, A tata McGraw Hill Publication New Delhi
8. Micro Hydel Design Manual by Adam Harvey, Intermediate technology Publication

SUGGESTED DISTRIBUTION OF MARKS

6.3 SCADA, PLC & MICROCONTROLLERS

	L	T	P
Periods/week	**6**	**-**	**3**

RATIONALE

A diploma holder when employed in automated industrial process controls or in automated power station will be required to know the basics of Programmable Logic Controllers, their working and their programming. In industry, many manufacturing processes demand a sequence of operation, which are to be performed repetitively. Early automation systems were mechanical in design, timing and sequencing being effected by gears and cams. Slowly these design concepts were replaced by electrical drives which were controlled by relays and now by programmable logic controllers (PLCs). A PLC is a solid state device, designed to operate in noisy industrial environments and can perform all logic functions. PLCs are widely used in industries for efficient control operations. A diploma holder in industry is called upon to design , modify and troubleshoot such control circuits. Looking at the industrial applications of PLCs in the modern industry, this subject finds its usefulness in the present curriculum.

Topic No.	Time Allotted (PERIODS)	Marks Allocation (%)
1	10	10
2	10	10
3	12	12
4	10	10
5	10	10
6.	30	32
7.	14	16
Total	96	100

Microcontrollers have also assumed great significance in the field of electronics and

common goods industry, and thus considered to be an important field of engineering. This subject aims to expose the students to both of these and give them adequate knowledge of these topics.

DETAILED CONTENTS

UNIT 1. SCADA **(15 Periods)**

Introduction, role of SCADA in dispatch centre , operator console, VDUs, Types of communication channels in SCADA systems, RTUs ,MTUs, data loggers, report generation, report analysis and actions.

UNIT 2. Introduction to PLC **(23 Periods)**

What is PLC, concept of PLC, Building blocks of PLC, Functions of various blocks, limitations of relays. Advantages of PLCs over electromagnetic relays. Different programming languages, PLC manufacturer etc.Working of PLC , Basic operation and principles of PLC , Architectural details.

UNIT 3. Instruction Set **(22 Periods)**

Basic instructions like latch, master control self holding relays. ,Timer instruction like retentive timers, resetting of timers. ,Counter instructions like up counter, down counter, resetting of counters.
Ladder Diagram Programming **:** Programming based on basic instructions, timer, counter, sequencer, and comparison instructions using ladder program.

UNIT 4: Micro Controller Series (MCS)-51 Over View **(21 Periods)**

Pin details ,I/o Port structure ,Memory Organisation ,Special function registersInstruction Set Addressing Modes :Timer operation ,Serial Port operation ,Interrupts

UNIT 5: Assembly language programming **(15 Periods)**

Assemblers and Compilers ,Assembler Directives ,Design and Interface,
Examples like: keypad interface, 7- segment interface, LCD, stepper motor. A/D, D/A, RTC interface Introduction of PIC Micro controllers

LIST OF PRACTICALS

PLCs

1. Components/sub-components of a PLC, Learning functions of different modules of a PLC system

2. Practical steps in programming a PLC (a) using a Hand held programmer (b) using computer interface

3. Introduction to step 5 programming language, ladder diagram concepts, instruction list syntax

4. Basic logic operations, AND, OR, NOT functions

5. Logic control systems with time response as applied to clamping operation

6. Sequence control system e.g. in lifting a device for packaging and counting

7. Use of PLC for an application(teacher may decide) :
   - Car parking
   - Doorbell operation
   - Traffic light control
   - Washing machine
   - Motor in forward and reverse direction

Micro Controllers

- Familiarization of Micro Controllers (8051) kit
- Testing of general input/output on Micro controller board
- Development of Electrical , Instrumentation applications using 8051 micro-controller
- Use of Microcontroller :like in relays, buzzer working machine, oven

INSTRUCTIONAL STRATEGY

Introduce the subject and make the students familiar with applications of PLCs and Microcontrollers. The inputs shall start with theoretical inputs to architecture, instruction set, assembly language programming, Small projects may be identified, be designed and implemented. PLC ladder diagram and programming should be supplemented with visits to industry. More emphasis may be given to practical work.

RECOMMENDED BOOKS

1. Programmable Logic Controller by Job Dan Otter; P.H. International, Inc, USA

2. Introduction to PLCs by Gary Dunning. McGraw Hill

3. Module on PLCs and their Applications by Rajesh Kumar, NITTTR Chandigarh

4. Programmable Logic Controller and Microcontrollers by Gurpreet Kaur and SK Sahdev by Uneek Publications, Jalandhar

5. Module on “Allen Bradlag PlC (SLC 500), Institution set-1, by Rajesh Kumar, NITTTR, Chandigarh

6. Module on “PLC Applications based on SLC 5/03” By Rajesh Kumar, NITTTR Chandigarh

7. The 8051 Micro controller by 1 Scot Mackenzie, Prentice Hall International, London

8. The 8051 Micro controllers Architecture, programming and Applications by Ayala; Penram International

9. Process Control Instrumentation Technology by Johnson, Curits; EE Edition, Prentice Hall of India, New Delhi

10. Microcontrollers by Ayala

11. Microcontrollers by Mazidi

12. Microcontrollers by Neil Makanzie

13. Microcontrollers by Deshmukh
14. Power system SCADA and smart Grids By Mini S. Thomas and John D. McDonald.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Period)	Marks Allocation (%)
1	15	16
2	23	24
3	22	22
4	21	22
5	15	16
TOTAL	**96**	**100**

6.4 APPLICATION OF COMPUTER SOFTWARES INELECTRICAL ENGINEERING

L T P
Periods/week 4 - 5

RATIONALE

In the present time electrical power system and service sector uses different type of software for different functions viz. planning and design, management, operation, quality control and optimization etc. Multi story building and special building designs are executed by using specialized computer softwares. It saves a lot of time and is cost effective. Many times alternative designs are also developed using softwares like AUTO CAD and CAD (Computer

Aided Design) etc. Most of the work of estimating and costing of big installations is done by using softwares. Softwares for electrical system are available for low voltage Electrical Installation, Maintenance and Training, Electrical Trouble Shooting, Simulation, Planning the Electrical Power Distribution etc. It is desirable that the present diploma holders should be well versed with the potential and use of commonly used softwares in the concerned field. Hence this subject is introduced.

DETAILED CONTENTS

1. MATLAB

Basics of MATLAB
Language Fundamentals
Syntax, operators, data types, array indexing and manipulation.

Mathematics
Linear algebra, differentiation and integrals and other mathematical operations.

Graphics
Two- and three-dimensional plots.

Data Import and Analysis
Import and export, preprocessing, visual exploration.

 SIMULINK

Getting Started with Simulink
Modeling
Simulation
Component-Based Modeling
Variant Systems

2 .MI POWER

3. MULTISIM

INSTRUCTIONAL STRATEGY

Introduce these softwares so that students will be given problems related to the functional areas of design and drawing of electrical control system, design of electrical distribution system, estimating and costing of the project etc. They will be asked to work on these problems manually. Then they will be asked to study the operational manuals of software for basic concepts and applications. Once they have understood, they will be asked to use the softwares for problem solving and comparing with the results done by the manual approach. Teachers will be required to prepare simple problems relating to the various softwares for developing competency in the diploma students. In addition the students must be exposed to different softwares and their capabilities demonstration by experts.

RECOMMENDED BOOKS

1. MAT LAB by Rudra Pratap .

2. Lab Manuals of MAT LAB etc. Supplied by Companies.

3.Lab Manuals of various softwares like MULTI SIM/ MAT LAB etc. Supplied by Companies.

6.5 PROJECT WORK

	L	T	P
Periods/week	-	-	8

RATIONALE

Project work aims at developing skills in the students whereby they apply in totality the knowledge and skills gained through the course in the solution of a practical problem undertaken

as a project work. The students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. It is also essential that the faculty of the respective departments may have a brainstorming session to identify suitable project assignments. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The students should identify themselves or be given project assignment at least two to three months in advance. The project work identified in collaboration with industry/field organization should be preferred.

Each teacher is expected to guide the project work of 5-6 students at a time. The project assignments may consist of:

a) Projects related with repair and maintenance of machine parts
b) Estimating and costing projects
c) Design of components/ parts/ jigs / fixtures
d) Projects related to quality control
e) Project work related to increasing productivity
f) Project connected with work study
g) Projects relating to erection, installation, calibration and testing
h) Projects related to wastage reduction
i) Projects related to energy audit

For students of Electrical Engineering Diploma Programme the project work can be grouped under the following four groups. A number of projects have been mentioned under each section. A student should take at least two projects both of which should not be from the same group. If more than two projects are taken to make up a total of 256 hours, then more than one may be taken from the same group as long as at least two groups are covered. Otherwise in case of more than two projects a student is free to choose one project from each section also.

Report for all the four project should be prepared and will give a seminar. The same will be assessed for internal and external assessment.

NOTE: (Two, only one from one group)

SECTION A

1.1 **Electrical Machines and Equipment:**

1.1.1 Design and Construction of a small transformer (100 VA to 1 kVA)

1.1.2 Construction of hot air blower

1.1.3 Design and Fabrication of Automatic curtain operator

1.1.4 Fabrication of Automatic Star-Delta starter

1.1.5 Construction of Automatic Water level controller

1.1.6 Construction of Choke for fluorescent tubes

1.1.7 Design and construction of loading rheostats minimum 5kw

1.1.8 Design and construction of Geyser

1.1.9 Erection/installation and commissioning of rotating electrical machine

1.1.10 Design and assembly of contactor control circuit for various applications

SECTION B

1.2 **Electrical Power:**

1.2.1 Drawing, estimating and costing of electrical installation of the institution from supplier's pole to the institution distribution board.

1.2.2 Drawing, estimating and costing of electrical installation of a workshop having a given number of electrically operated appliances/machines.

1.2.3 To study the laying of underground distribution cable for a small colony starting from main distribution pole

1.2.4 To study the erection erect a 5 pole span overhead line for a small distance for distribution of electrical energy. To energize it and prepare list of material and cost estimates.

1.2.5 Energy audit for the workshop of your institution and to suggest remedies to have low Electricity Bill

1.2.6 Case study of Electrical fire detection and protection system provided in a building

1.2.7 To survey the load of given area in a village, small colony, calculate the effective load and find out the sizes of the cables/conductors for the proposed distribution system

1.2.8 Designing of light and fan scheme for a institutional or commercial building

1.2.9 To prepare a plan for augmentation of a nearby pole mounted sub station

1.2.10 To prepare a proposal for substation of your institution, calculating the total load

(estimating and costing)

1.2.11 Power factor improvement in a industry

SECTION C

1.3 Electronics Based Projects:

Fabrication of:

1.3.1 Voltage Stabilizer for refrigerator, air-conditioner

1.3.2 Emergency light using SCR

1.3.3 Power amplifier

1.3.4 Low cost intercom for home

1.3.5 Analog computer

1.3.6 Regulated power supply 30V/1Ampere

1.3.7 Fabrication of online UPS

1.3.8 Inverter circuit 500 watt/1 KVA.

1.3.9 Solid State Control of Traffic Lights

1.3.10 To develop a computer network (LAN) in building

1.3.11 Lighting control by small circuit

1.3.12 Design of safety measures in intelligent building

SECTION D

1.4 Fabrication and Testing of:

1.4.1 SCR operated automatic water level controller

1.4.2 SCR based speed controller for DC shunt motor

1.4.3 Three phase full wave rectifier using power diodes

1.4.4 Timer circuit using 555-IC

1.4.5 SCR controlled rectifier circuit

1.4.6 Inverting and non-inverting amplifiers using OP AMP(741)

1.4.7 Comparator circuits using OP AMP (741)

1.4.8 Project using PLC

1.4.9 Project relating to Microprocessor

1.4.10 Project relating to Microcontroller

Special Project: If a group of student develops a small entrepreneurial product, then other project is not to be done by them.

Note: The quality of end-product and process adopted by the students in its execution should be taken into consideration along with other parameters while evaluating the students

A suggestive criteria for assessing student performance by the external (personnel from industry) and internal (teacher) examiner is given in table below:-

Sr. No.	Performance criteria	Max. marks	Rating Scale				
			Excellent	very Good	Good	Fair	Poor
1.	Selection of project assignment	15	15	12	10	07	04
2.	Planning and execution of considerations	15	15	12	10	07	03
3.	Quality of performance	25	25	16	12	08	04
4.	Providing solution of the problems or production of final product	25	25	16	12	08	04
5.	Sense of responsibility	15	15	12	10	07	03
6.	Self expression/communication skills	10	10	08	06	04	02
7.	Interpersonal skills/human relations	10	10	08	06	04	02
8.	Report writing skills	15	15	12	10	07	04
9.	Viva voce	20	20	16	14	08	04
Total marks		**150**	**150**	**112**	**90**	**60**	**30**

The overall grading of the practical training shall be made as per following table.

In order to qualify for the diploma, students must get "Overall Good grade" failing which the
students may be given one more chance to improve and re-evaluated before being disqualified
and declared "not eligible to receive diploma ". It is also important to note that the students must get more than six "goods" or above "good" grade in different performance criteria items in order to get "Overall Good" grade.